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Information content and task performance: A study of older workers.

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INFORMATION CONTENT AND TASK PERFORMANCE:

A STUDY OF OLDER WORKERS

by

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I wish to dedicate this work to my family

ABSTRACT

A study was conducted to investigate the variation in speed of performance and decision making ability with age. Twenty volunteers from local industry formed the subject group. Ten of these ranged in age from 52 to 63 years. The control group ranged in age from 18 to 29 years. The task performed involved decision making, hand movement and positioning elements. Three levels of information load (2, 3 and 4 bits), four distances of move (7", 10", 13" and 16"), and four levels of radial clearance (0.008", 0.063", 0.25" and 0.75") were taken as independent variables. The dependent variable, performance time, was composed of the decision and movement time components (DT and MT). In addition, heart rate was also monitored.

It was found that age was a significant determinant of performance time ($p < 0.05$). The components of performance time, i.e., decision and movement times were both significantly higher for the older subjects as compared to the younger ones ($p < 0.05$) reflecting the fact that there is some natural slowing of psychomotor function with age in such combined manual and decision tasks. The information load and the distance of move were significant determinants of decision time and also of movement time ($p < 0.05$). The clearance was a significant determinant of movement time ($p < 0.05$). The difference between the older subjects and the younger subjects in decision time increased with an increase in the information load. An analysis of the performance errors for the self paced task indicated that the slowing among the older subjects was not observed at the expense of accuracy. The study provided no evidence that age has an effect on heart rate variability under different levels of information load and task difficulty.

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CHAPTER I

INTRODUCTION

The proportion of older people in the Canadian population has increased over the past decade (Table 1.1). Data from the Canadian census (1971) indicates that the proportion of older people [over 50 years old] was about 21% of the total population in 1971 and the estimated population for 1975 shows an increase to about 23.5%. The change in age composition is due not as much to any marked extension of the span of life but to a far greater survival rate during infancy and childhood (Figure 1.1).

Data from Statistics Canada (1978) indicate that workers over 50 years old comprise 19% of the work force in Canada. In industry, older workers provide many advantages in quality of performance, in steadiness, in reduced absenteeism, in responsibility and in reduced costly labour turnover (Heron and Chown 1960; Murrel, et.al, 1957). There are, however, problems of employment associated with age which begin to make themselves apparent as early as the late forties. These problems leave no doubt that industry should take greater account of the need to fit jobs to older workers and this can be achieved in one of two ways:

1. Reallocation of the worker to another job.
2. Re-design of the job.

The first method (reallocating the worker to another job) appears at first sight to be an attractive and easy solution; however, it often involves more expenditure than is generally admitted due to the long period of training and adaptation which is frequently required. At the same time the transferred worker's output is often lower than normal for a

Table 1.1 The proportion of older people (over 50 years old) in the Canadian population, 1921-1971 [taken from Canadian census (1971)]

Year	Total population	Population of people over 50 years old	%
1921	8,787,949	1,304,274	14.8
1931	10,376,786	1,726,957	16.6
1941	11,506,655	2,273,562	19.8
1951	14,009,429	2,825,771	20.2
1956	16,080,791	3,131,149	19.5
1961	18,238,247	3,543,812	19.5
1966	20,014,880	4,007,504	20.0
1971	21,568,310	4,528,685	21.0

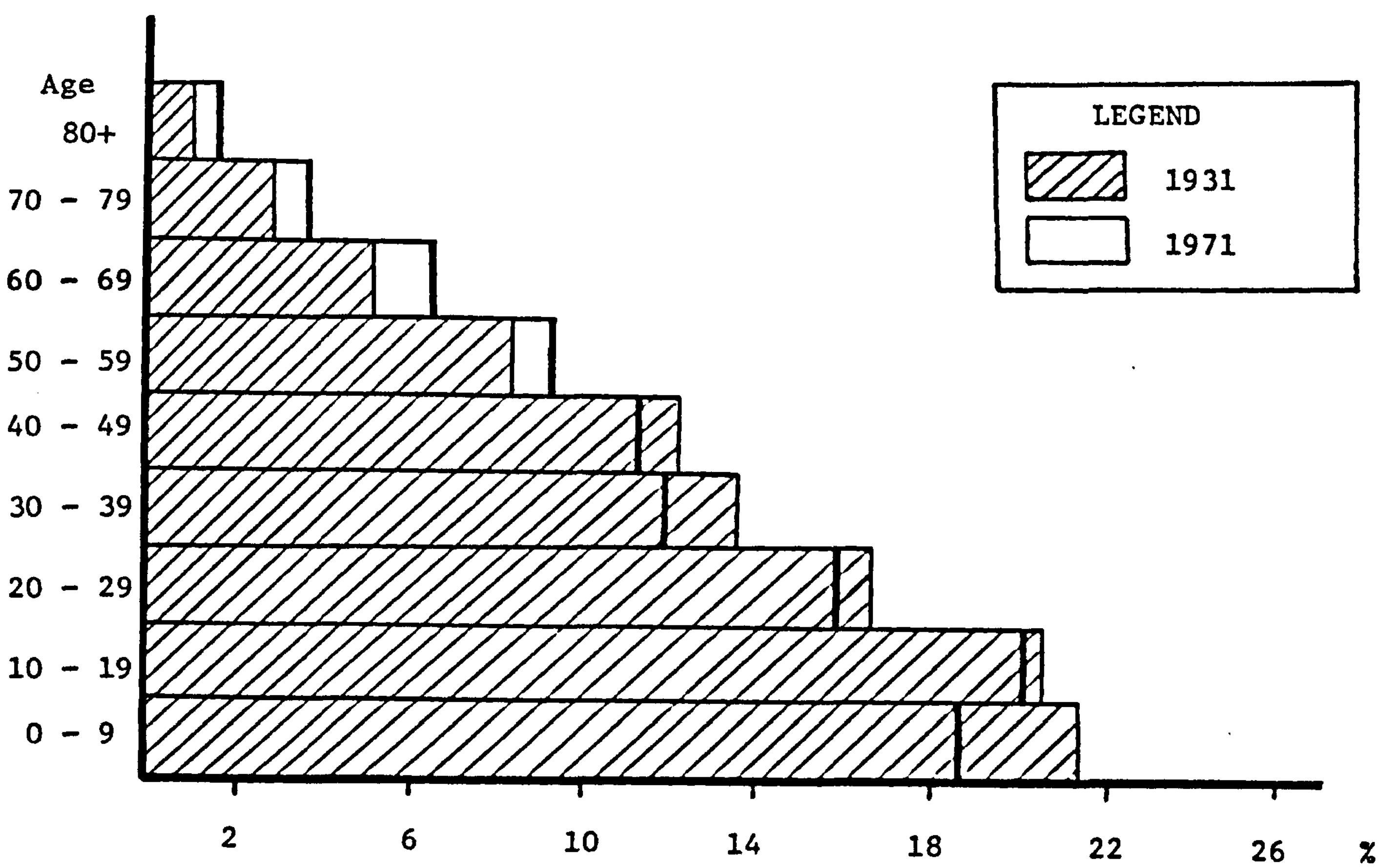


Figure (1.1) Percentage distribution of population by Age groups, Canada, 1931 and 1971 .

considerable length of time and the worker's skills are being under utilized in a less demanding job. Reallocation also involves considerable upheaval for the worker himself (Marbach, 1968) since family and other social ties have often been developed by that age.

The second method is to redesign the job so that the older worker will be capable of meeting its demands. Job redesign will result in the reduction of labour turnover among older workers, accidents due to fatigue and absence due to illness (Griew, 1964). In order to undertake such job redesign,it is essential to know the effects of ageing on working capacity and performance, motivational levels,and economic needs of the worker himself. Experimental and explorative studies are therefore needed to investigate work performance and motivation and their relationships to age.

Some laboratory studies have been reported concerning several aspects of ageing industrial workers. Astrand (1960) has shown that ageing reduces the capacity to perform manual activities for prolonged periods of time. Bink (1962) has shown that the average capacity for manual work at age 55 is 25% lower than that at 19 years of age. The laboratory results of Murrell and Griew (1957) reflect the industrial finding that older workers tend not to be working on the most complex and/or skilled jobs. In a study of the change in speed of performance with age performed by Welford (1962), it was shown that older people tend to drop out of work that makes severe demands for speed and fine visual discrimination. He inferred that light work requiring a fast rate of operation is less suitable for people over 50 years of age than is moderately heavy work.

With increased industrialization and improvement of production equipment and production systems, there is a general increase in light tasks (e.g. modern electronic control systems) and a decrease in heavy tasks (e.g. manual material handling). It should be borne in mind that the human operator of these modern systems has become progressively less concerned with continuous manual monitoring and more and more concerned with the interpretation of a large variety of signals for action. These signals may originate from different sources simultaneously or in rapid succession and he is always required to exercise his decision making abilities.

Many studies have been done to investigate the performance of the worker in such tasks. In most of these studies the subjects were young, mostly under 30 years old. Some studies on the effect of ageing on reaction time and movement time have been reported in the psychological literature (Spirduso, 1975; Simon, 1967; Singleton, 1954; Szafran, 1951) but none on the study of the interactive effectsof age and the information content of the task. The present study attempted to investigate these interactive effectson the decision time, movement time, accuracy of performance and heart rate of the worker. The objectivesof the study, the method, the experimental design and procedure, and the results are discussed in detail in the following chapters.

CHAPTER II

LITERATURE SURVEY

2.1 Introduction

This chapter briefly summarizes the existing studies and serves as a background to the present study. The work done in the following areas is presented in this chapter:

(1) Information content and task performance.

(2) Age differences in reaction time.

(3) Age differences in reaction and movement time.

(4) Effect of age on speed and accuracy of movement.

(5) Task performance and heart rate.

2.2 Information Content and Task Performance

Three experiments are reported by Fitts (1954) which were designed to test the hypothesis that, if the amplitude and tolerance limits of a task are fixed and the subject is instructed to work at his maximum rate, then the average duration of response will be directly proportional to the minimum average amount of information per response demanded by the task conditions. The three experiments were as follows: -

1. The subjects were asked to tap two rectangular metal plates alternatively with a stylus for different plate widths and different distances between plates.
2. The subjects were asked to transfer plastic washers from one pin to another using different distances between the two pins and different clearances between the washer and the pin.
3. The third task was to transfer pins from one set of holes to another

using different distances between the holes and different clearances between the hole and the pin.

As a result of these three experiments, Fitts proposed an index of difficulty of movement on the assumption that the average amplitude, the average duration, and the amplitude variability of successive movements are related in a manner suggested by information theory. This index of difficulty is defined as:

$$ID = \log_2 \frac{2A}{W} \qquad (2.1)$$

where W is the tolerance range in inches and A is the average amplitude of the particular class of movements. The choice of denominator for this index is arbitrary since the range of possible amplitudes must be inferred.

Fitts also found that movement time was well predicted by the relationship.

$$MT = a + b \cdot ID \qquad (2.2)$$

where MT is the movement time and a and b are constants.

Welford (1960) has suggested that an improved index of task difficulty might be;

$$ID' = \log_2 \frac{A + 0.5W}{W} .$$

This formulation makes movement time dependent upon Weber's fraction ($\frac{\Delta S}{S}$, where ΔS = a just noticable change and S = physical stimulus magnitude) in that the subject is called upon to distinguish between the distances to the far and to the near edges of the target. This suggestion also is based in part on the observation that this definition reduces the numerical value of the first constant, a , in Fitts' equation (2.2), giving theoretical predictions of MT near zero for IDs of zero, since it has the effect of moving the best fit line from intersecting the movement time axis at a negative quantity of intersect at a positive quantity.

Fitts and Peterson (1964) studied the effects of response amplitude and terminal accuracy on two-choice reaction time and movement time. Six male subjects, 18 - 25 years of age were used. The subjects' task was to hold a light weight metal stylus on a small metal starting plate fixed at a point midway between two signal lights, and when one of the lights came on, the subject attempted to hit the appropriate one of two alternative targets as quickly as possible. They found that both the required amplitude of movement and the width of target had a large and systematic effect on the movement time, but a relatively small effect on reaction time. Movement time can be influenced quite independently by (a) the degree of uncertainty of the stimulus and (b) the degree of uncertainty permitted in executing the movement (Fitts and Peterson, 1964). These findings support the view that perceptual processes and motor response are relatively independent, and that human information processing proceeds by a series of essentially independent steps (Broadbent, 1958; Welford, 1960).

From information theory, if i is a signal from a message consisting of a sequence of signals, chosen by a source from a set of statistically independent signals, and if i has a probability of occurance p_i , then:

Information in signal $i = -\log_2 p_i$, which is called the "entropy" of the source and is measured in bits (Shannon and Weaver, 1949). For N equally likely stimuli, and no response errors, the entropy

$$H = \log_2 N \text{ bits}$$

which is non-negative, has no upper bound as N increases and is additive. It is also used as a measure of informational load.

Once information has passed through the perceptual stage of processing, a course of action must be chosen. Decision processes can be examined by simple reaction time and more directly by choice reaction tasks (Stelmach and Diewert, 1975).

The term "combined decision and manual task" was used by Sadosky (1969), for the tasks in which the worker is required to exercise both his manual dexterity and decision making abilities. Thomas (1971) after studying the performance time for a combined decision and manual task, concluded that the decision component of the task might be considered as an isolated entity and its time a function of the input uncertainty and the movement involved, Tsui (1977), using a task similar to the one used in the present study, studied the performance time for ten male and ten female subjects under four levels of information load and three levels of task difficulty. He found that index of difficulty and information load were significant in their effect on performance time, but no differences were observed between male and female subjects.

2.3 Age Differences in Reaction Time

2.3.1. Simple Reaction Time

The Reaction Time (RT), which traditionally is taken as the period elapsing between the appearance of a stimulus and the beginning of a response movement, is also traditionally regarded as a measure of the time taken by central processes (Welford, 1959). The results of various psychological studies of simple reaction time have shown that RT tends to lengthen with age but only by small amounts (McFarland, 1959).

An experiment by Singleton (1954) showed no difference of age change in reaction time with different complexities of movement. The subject's task was to move a lever from one to the other end of an 18 inch slot in response to a signal light. Each subject performed a number of trials in which he moved the lever in one direction only and others in which he moved it from one end to the other and back.

Conflicting evidence comes from an experiment by Griew (1959) in which subjects were required to move a stylus over a distance of 8 inches from a metal disk 1.25 inches in diameter to another metal disk at the appearance of a signal light. For the younger subjects no consistent increase was found when the more complex movement was required. The older subjects, however, took consistent and significantly longer, on the average, to initiate their responding movement under this condition.

Simon (1967) studied the effect of reversal of right and left ears in auditory Signal-Response (S-R) correspondence on the reaction time of two disparate age groups. He found a significant difference in reaction time as a function of age, sex, and S-R correspondence. Reversal of the S-R relationship produces significantly greater slowness for older than for younger subjects

2.3.2. Discrimination and Choice Reaction Time

Research by Hick (1952), Hyman (1953), and Crossman (1953) has indicated that choice reaction time is roughly proportional to the amount of information transmitted from the display of signal source to the responding action. RT, therefore, is linearly related to the logarithm of the number of equiprobable choices, or their equivalent.

Hick's formulation may be expressed as:

$$RT = K \log N_e \qquad (2.3)$$

where

RT = Reaction time

N_e = The effective number of equiprobable choices

K = constant depending on the nature of the relationship between the signals and the responding action required.

Crossman (1955) has shown that a different formulation is required for the effect of different degrees of discrimination and he suggests the following formula.

$$T_d = C/(\log X_1 - \log X_2) \qquad (2.4)$$

where T_d = Discrimination time

X_1, X_2 are the quantities being compared (e.g. length of two lines), and C is constant.

Three experiments by Crossman and Szafran (1956), using a sorting task, have shown that choice and discrimination time did not increase proportionately with age, that is, age change cannot be described as an increase of K or C in equations (2.3) or (2.4).

Fozard (1972) studied the effect of age and socioeconomic status on two sets of measures of cognitive performance. One set consisted of 12 subsets of the General Aptitude Test Battery; the other was a group of laboratory-based experiments. He found that it is more difficult for older individuals than for younger ones to (a) retrieve special information from short term memory, (b) monitor two verbal sequences concurrently, and (c) initiate a response in two-choice discrimination.

2.4 Age Differences in Reaction and Movement Time

Szafran (1951) tested ten subjects in each age decade from the twenties to the fifties on an aiming task. The subject sat in the center of a wooden framework and moved a stylus from a central resting point to any one of a number of 14-inch targets, with 1-inch metal centers, distributed on three sides around him. He found that the time taken to move from the resting point to contact with the target increased slightly with age, but not significantly, and comparatively less than various stationary components, such as time of initiating response.

In an experiment conducted by Leonard (1952), the subject's task was to move the stylus from the center disk to the outer one corresponding to the particular light on a display consisting of five lights. He found that,while all the time components of the task increased with age, there were indications that the speed decrement was greater for the times on the center disk and outer disk than it was for the transit time between disks.

Singleton (1954) used a display consisting of four lights arranged in a square, with one diagonal positioned vertically. The control was a lever, which could move along four directions from a center point. Each light signal indicated a direction of movement. He found that until the forties or fifties, the actual time spent making movement did not increase or increased little with age. The slowing of performance occurs mainly during those portions of a task where changes in the direction of movement are necessary, in other words, in the reaction time. Welford (1959), after discussing the experiment by Singleton, reported that "in such experiments which required series of reaction time, it is difficult to be sure whether any lengthening of time is due to processes concerned with the initiation of a responding movement or with processes which in some way are an aftermath of a previous movement".

In a study by Tolin and Simon (1968) to investigate the effect of task complexity and stimulus duration on perceptual-motor performance of two disparate age groups, it was found that older subjects reacted 30 percent slower and moved 76 percent slower than younger ones. The subject's task was to make an unguided movement to the onset of one stimulus light in a four light display. Two stimulus durations were used, 0.11 second and 2.0 seconds. It was found that both reaction time and movement time were slower for the complex than for the simple task. Younger subjects moved faster with the 0.11 second stimulus while older subjects moved faster with the 2.0 seconds stimulus. The slowness of the older subjects following the shorter-duration stimulus may be related to unreliability of short-term memory.

In a study by Spirduso (1975), the subjects were categorized into young (20-30 years), old (50-70 years) and into whether they were active sports participants or non-active participants. The results for simple RT, choice RT and movement time indicate that the active groups were more co-ordinated than non-active groups and that the younger subjects were faster than the older subjects. It was also found that the old non-active group was significantly slower than the other three groups on all three dependent measures. From these results it may be inferred that a highly active sports life tends to compensate, to some extent, the normal slowing in response with age.

2.5 Effect of Age on Speed and Accuracy of Movement

Indications of speed and accuracy together were obtained in a figure-tracing experiment by Brown (see Welford, 1958). He found that subjects up to the age of thirty maintained speed at the expense of accuracy but from the forties onward, accuracy was restored at the expense of speed.

Davies (1975), using a task requiring cancellation of letters in a text, found that older subjects worked significantly more slowly and significantly less accurately than younger ones. However, noise significantly improved the rate of work for older subjects but not for younger ones without impairing accuracy. Older subjects, but not younger ones, also were significantly more accurate in the afternoon. An interpretation is given for the previous result by Davies, as follows. Older subjects normally function at a lower level of arousal than do younger subjects; furthermore, the relationship between arousal level and performance follows on inverted-U, performance rising with increasing arousal until it reaches an optimal point and thereafter declining. Since noise at low intensities and afternoon testing both raise arousal level, this results in the older subjects, who are further away from the optimal point initially, approaching it more closely, their performance thus showing a relatively greater improvement than that of younger subjects under conditions that increase arousal level.

Many changes in cortical function can be attributed to a slowing of signal-to-noise ratio in the brain. Older people, however, seem often to compensate by accumulating data over a longer time, thus strengthening the signal and averaging out some of the noise, before triggering the decision. This results in slower performance, but avoids an increase of errors, and in some cases leads to older people being more accurate than their younger counterparts (Welford, 1976).

2.6 Task Performance and Heart Rate

As a person performs work, either mental or physical, certain physiological changes take place within the human body. One rather easily measurable change is the heart rate, which is known to increase above the "rest" rate as work is performed (Young, 1956). Kalsbeek (1971) suggested that changes in the variability of the instantaneous heart rate could be used to indicate changes in mental load. In addition to work load, such factors as temperature, humidity, impervious clothing, sex, age, state of nutrition, physical conditions, self consciousness, emotional state, accumulated fatigue, and training have all been found to affect either the level of heart rate during exercise or the rate of heart recovery following exercise (Brouha, 1954, 1962). Heart rate is also affected by stressors such as drugs, noise, and lack of sleep, and by general characteristics of the task such as novelty, complexity and the prevailing intensity of task stimuli (Kahneman, 1973). Time-on-task also has an effect on the heart rate (Gaillard and Trumbo, 1976; Thackray et al, 1974). Khare (1976) found that heart rate increased when the information load increased while reach remained constant and when the magnitude of reach increased while information load remained constant.

In an experiment by Young (1956), 14 male subjects between the ages of 23 and 31 served as operators in pumping the handle of an apparatus at prescribed work paces of 80, 100, and 120 double pump strokes per minute.

It was found that the means of the heart rate, taken immediately following work,were highly significantly different for each of the three selected paces, and the correlation coefficient for the relationship between heart rate immediately following work and the pace used by the operators during the work ranged from 0.889 and 0.999 for the fourteen operators.

Conflicting results concerning the effect of age have been reported among those investigators who used heart rate as an index of work capacity. Robinson (1938) and Yiengest (1953) found higher heart rate in older subjects than in younger subjects while performing work at fixed levels. Astrand (1958) also found an increase in heart rate at submaximal work with increasing age. However, the results of Snook (1965) who reports no increase in heart rate with increasing age while performing work at a fixed level suggest to the contrary. Furthermore, Brouha (1962) concluded that for moderate work, any changes in heart rate with age occur only under stressful conditions such as hot and humid environment.

2.7 Conclusions

A review of the literature summarized in this chapter reveals that most of the previous studies on the effect of age were concerned with the main effect of age on the performance. In other words, the hypothesis that with increasing age there is slowing in the performance has been tested. This is now accepted as fact. Since the problem of ageing is associated with the problem of employment, there is a need to investigate this slowing in the performance and the effects of variations in the information content of the task on this slowness. In other words, it is necessary to investigate the interactions between age and information content of the task. An appropriate interpretation of the findings of such studies could then be transformed into meaningful policies for worker placement and could be used as a guide for job redesign for older workers and for effective manpower planning.

CHAPTER III

THE STUDY

3.1 Objectives of the Present Study

The objectives of the present study are to investigate the effects of age and information content on performance in a combined decision and manual task. Only choice-uncertainties are involved and there is no preview of the stimulus signals. More specifically, the interactive effects between the above variables will be examined.

The following hypotheses were tested:

(a) With an increase in information load and the index of difficulty, both the decision and movement time components of performance time increase but by greater amounts for the older group than the younger group.

(b) The accuracy of performance is higher for the older group than the younger group.

(c) Increasing the information content of the task has a greater effect on increasing the heart rate of the older group than the younger group.

3.2 Method

The study was conducted within the Industrial Engineering laboratories at the University of Windsor. Two groups of subjects participated in this study. Each subject performed 12 experimental runs on a combined decision and manual task designed for the purposes of the study. The criteria for the selection of subjects, the apparatus used in the study and the different experimental runs are described in the following pages.

3.2.1 Subjects

Two groups of subjects participated in this study:

(1) Younger Group

The younger group consisted of 10 male subjects between the ages of 18 and 29 with an average age of 23.5 years. The subjects were chosen from among industrial workers in the Windsor area. All subjects were holding jobs in different types of industry but had taken time off to participate in the study. Table 3.1 summarizes the relevent information. Each subject was paid for participating in the experiment.

(2) Older Group

The older group consisted of 10 male subjects between the ages of 52 and 63 with an average age of 59.5 years. The subjects were chosen randomly and with the co-operation of the Canada Manpower Center from among industrial workers in the Windsor area. The older subjects were from among the workers who were "between assignments" for a period less than 6 months and for reasons other than disability. Table 3.2 shows the age distribution for the older group and the type of industry and years of experience for the last job held by the subject.

All subjects in both groups were right-handed and in apparent good health. The purpose of the study was explained to the subjects and they all appeared to be interested in participating.

Table (3.1) The Younger Group

Subject number	Initials	Age	Type of Industry	Years of Experience
1	S.A.	29	Stamping	1
2	V.T.	28	Stamping	3
3	D.W.	22	Chemical	3/4
4	A.W.	24	Forging	2
5	R.G.	18	Automotive	1/6
6	R.C.	21	Automotive	1½
7	M.L.	23	Automotive	2/3
8	S.C.	24	Automotive	2
9	Y.Y.	26	Automotive	4
10	W.S.	21	Automotive	1/2

NOTE: Type of industry and length of experience is for the last job held by the subject.

Table (3.2) Older Group

Subject number	Initials	Age	Type of Industry	Years of Experience
1	H.S.	62	Forging	40
2	E.K.	61	Forging	26
3	D.W.	53	Forging	10
4	G.R.	63	Food Industry	30
5	W.K.	57	Machine shop	7
6	R.B.	59	Chemical	22
7	R.L.	59	Automotive	30
8	G.D.	58	Automotive	9
9	R.P.	62	Automotive	37
10	J.M.	61	Automotive	27

NOTE: Type of industry and length of experience is for the last job held by the subject.

3.2.2 Apparatus

The experimental apparatus consisted of the following units (Figure 3.1):

(a) Signal-Response Unit (S-R)

(b) Tape Reader Unit

(c) Time Measuring and Recording Unit

(d) Heart Rate Recording Unit.

(a) Signal Response Unit

A special S-R unit (Figures 3.2 and 3.4) was used in this study (Tsui, 1977). The task consisted of the subjects' grasping the pin, 0.625" of which rested above the surface of the work board. The system had been so designed that, as soon as the pin is lifted from its resting position, a number on the light emitted diode (LED) screen would appear to indicate the hole number into which the pin should be dropped (see Figure 3.2 also Tsui, 1977). The subject would look at this number on the LED screen and in one sweep reach for the hole, position and drop the pin. This constituted a task cycle which was then repeated.

The S-R unit consisted of the following components:

(a.1) The Pin System

The pin system as shown in Figure 3.5 consists of six cylindrical metal pins, each 0.25" in diameter and 1.25" long. Only one pin stands in the pin pocket with half of its length appearing above the surface of the work board. The pin system is designed such that as the pin is removed from the pin-pocket, another pin appears to take its position. When it is positioned and dropped into the appropriate hole, it is carried by a conveyor belt to the pin-pocket region (Tsui, 1977).

(a.2) The Response Top Plate

The S-R unit was designed such that the response top plate is interchangeable. There are 4 plates, each having 16 holes of equal size arranged in a 4x4 matrix, but each plate has a different hole size. The four different hole sizes are 0.258", 0.313", 0.5" and 1" in diameter. Numbers 1 to 15 and number 0 were labelled above the sixteen holes and the arrangement of these numbers was the same on the four plates. Number 0 was used instead of 16, because it was within the range of the BCD signals used by the tape reader. This facilitated the making of the random number tape. The dimensions and the hole arrangements of the response plate are as in Figure 3.4.

(a.3) The Signal Indicator

The random numeric signal is transmitted from the tape reader and displayed onto a rectangular screen (1 inch by 0.75"), located 4 inches above the pin-pocket (see Figure 3.4). The number appears only on the screen as the subject grasps and lifts the pin from the pin-pocket. The number continues to be displayed until the removed pin has been dropped into the specified hole, If, in error, the removed pin is positioned into a wrong hole, the number on the screen remains displayed until a following pin is grasped, removed and positioned into the correct hole. This feature allowed an easy identification of errors of positioning.

(a.4) The Photocell System

As shown in Figure 3.4 an adjustable photocell system was developed in order to measure the time between occurrence of stimulus (grasping and lifting the pin and thus triggering the numeric display) and initiation of movement (crossing the photocell beam) toward the specified hole. The "holding time" before starting the positioning movement was thus taken to be the decision time. The photocell system was adjusted and fixed such that the photocell beam was at a height of 1 inch from the surface of the S-R unit and at a distance of 1 inch (horizontal) from the pin-pocket. It was found that this position for the photocell beam was the closest position to the pin-pocket which insured no interference between the subject's hand and the beam while grasping the pin. At the same time this position eliminated the possibility of interrupting the beam during the positioning movement.

(b) Tape Reader Unit

The tape reader unit (Figure 3.3) consisted of the random number tape and the tape reader. The tape reader reads the programmed tape and sends signals to the S-R unit. This appears in the form of a random number on the LED screen. The random number tape is a standard computer paper tape punched on a teletype punching machine using the IBM BCD system code. Three tapes were prepared for the 4, 8 and 16 hole tasks, with equal probability of occurrence of each number in each set.

(c) Time Measuring and Recording Unit

This unit (Figure 3.3) consisted of two time counters and a DIGITEC paper tape punch unit. The first time counter was for measuring the time between the appearance of the stimulus (grasping and lifting the pin) and initiation of movement (crossing the photocell beam). This represented the decision time. The second time counter was for measuring the total time (performance time) measured between the appearance of the stimulus and the completion of the movement by positioning the pin in the correct hole.

The output measures, that is performance time, decision time (both in milliseconds) and the hole number were punched on a paper tape. This tape was then converted into computer cards for the analysis.

(d) Heart Rate Recording Units

In order to record the heart rate, Model 7 P6 EKG pre-amplifier, connected to a Grass model 7 polygraph, was used. The amplifier was connected to the subject through three electrodes applied to the subject's chest and the heart beats were recorded on Grass recording paper (see Figure 3.1).

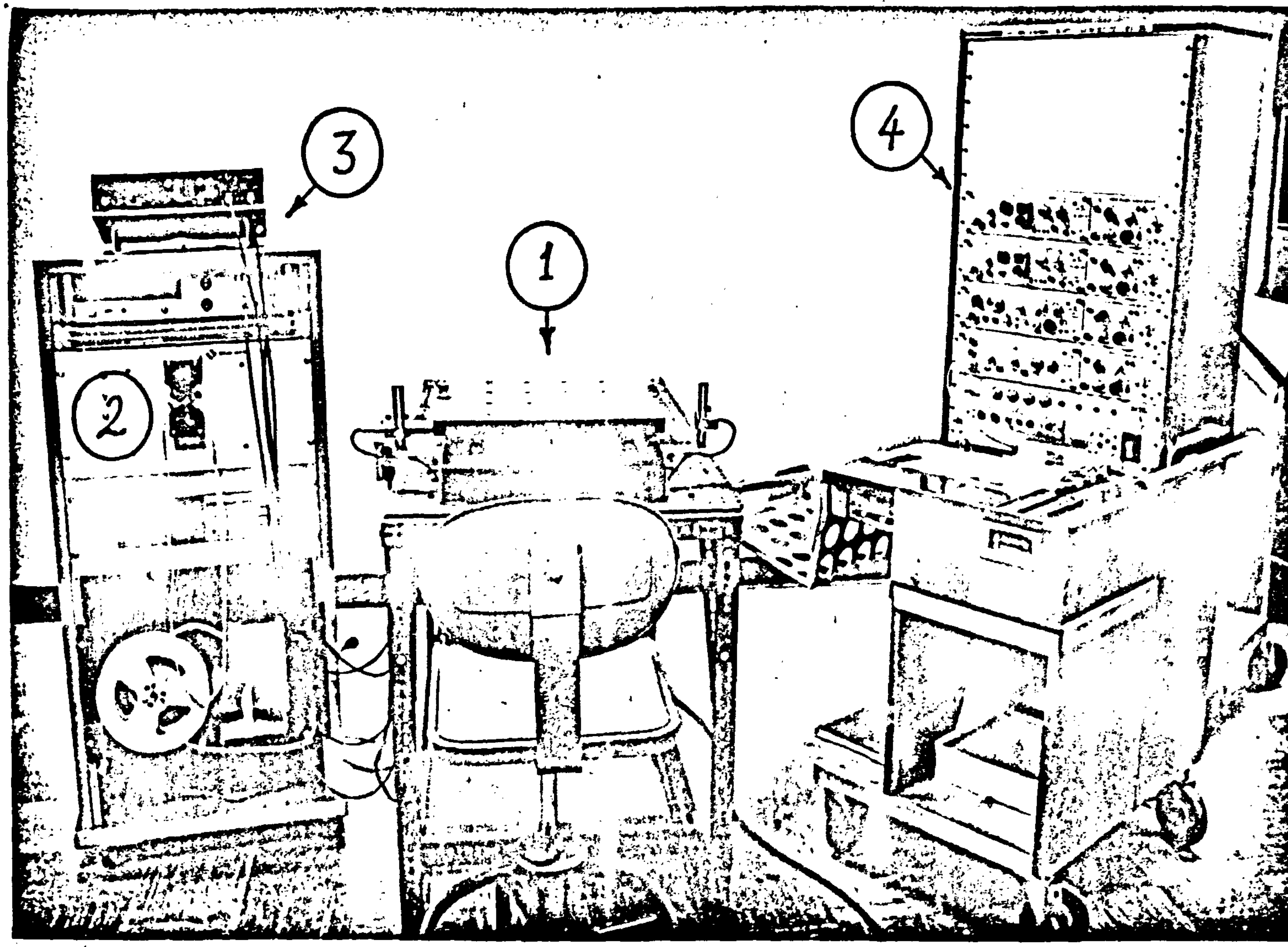


Figure (3.1) Equipment Set-Up

1. S-R Unit
2. Tape Reader Unit
3. Time Measuring and Recording Unit
4. Heart Rate Recording Unit

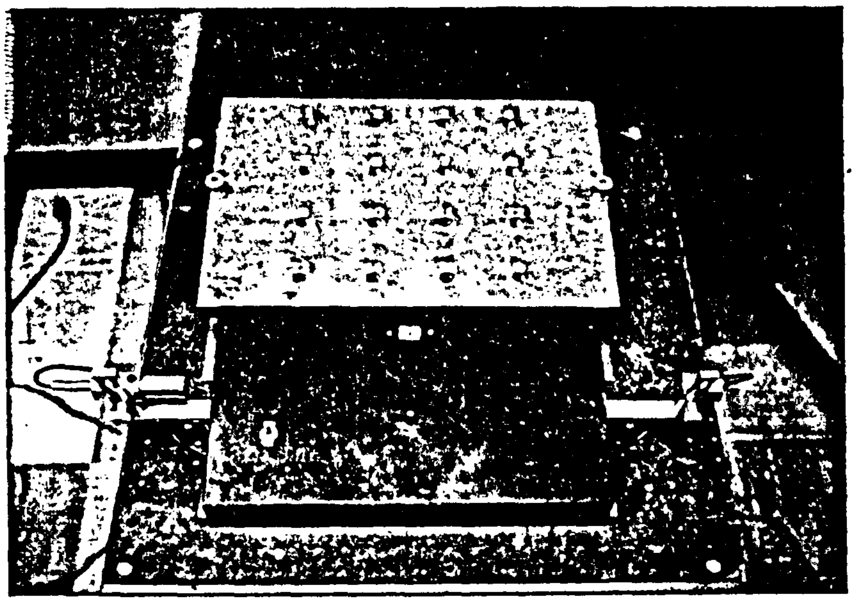


Figure (3.2) Signal-Response Unit

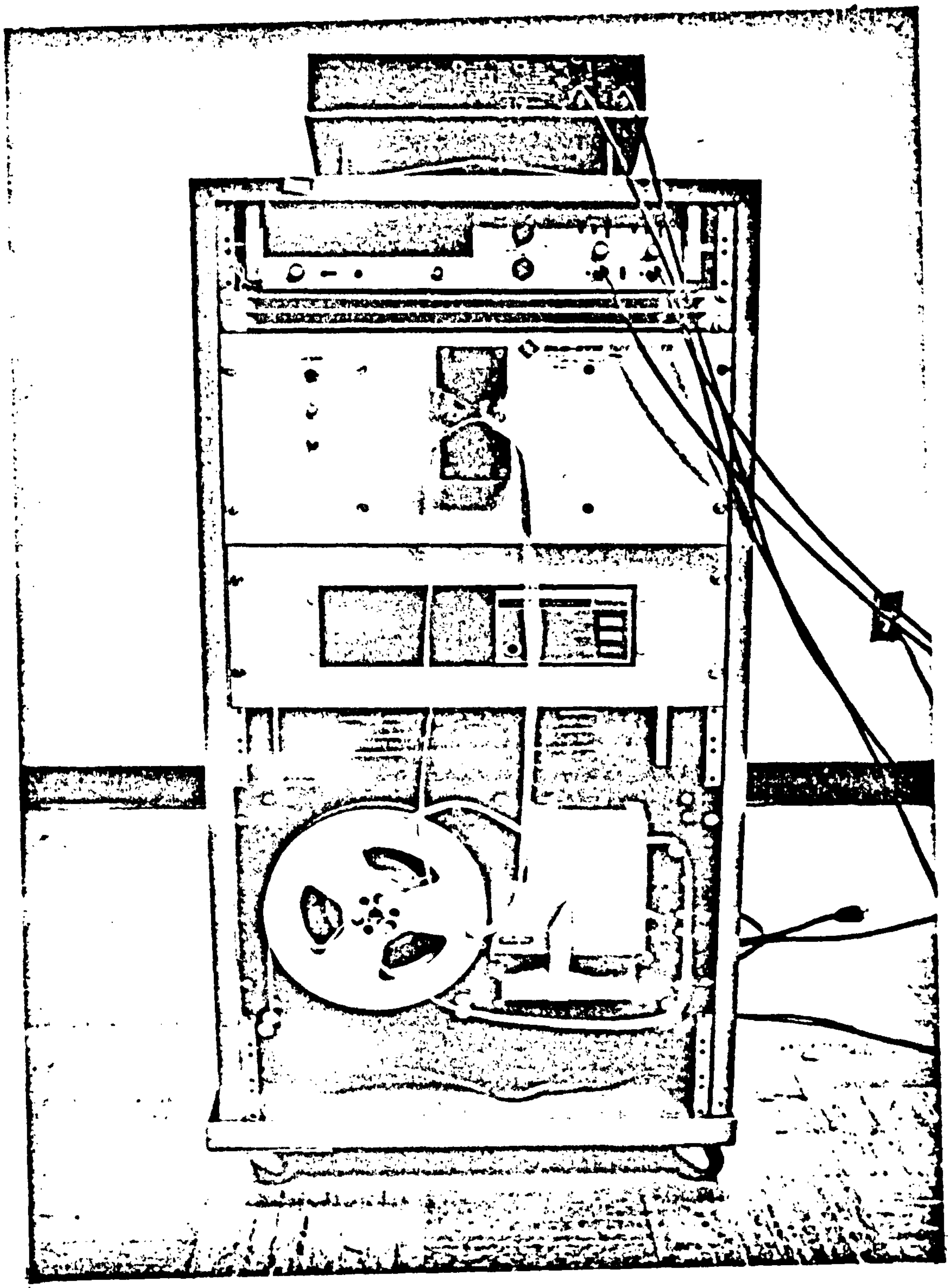


Figure (3.3) Time Measuring, Recording and Tape Reader Units

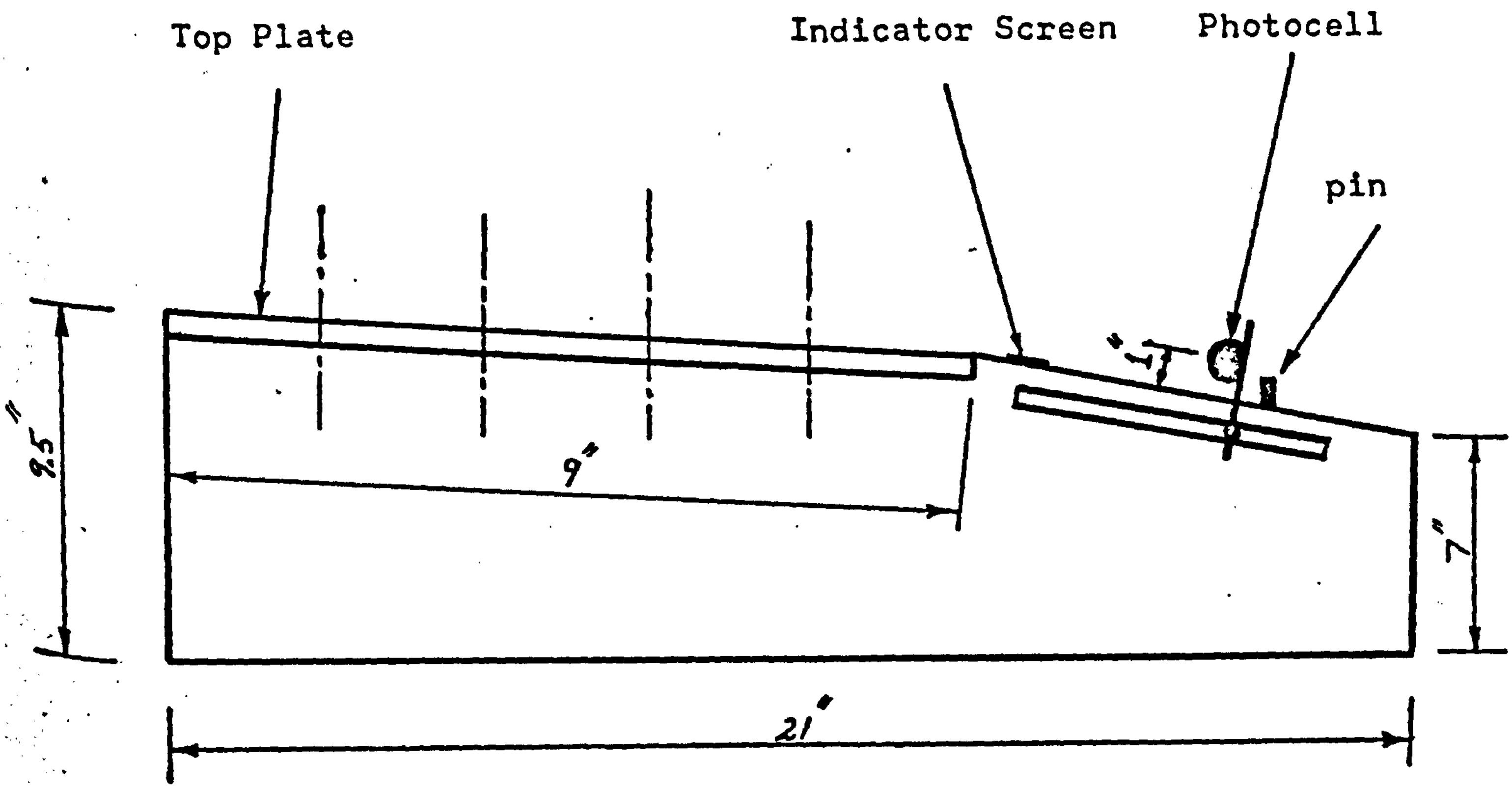
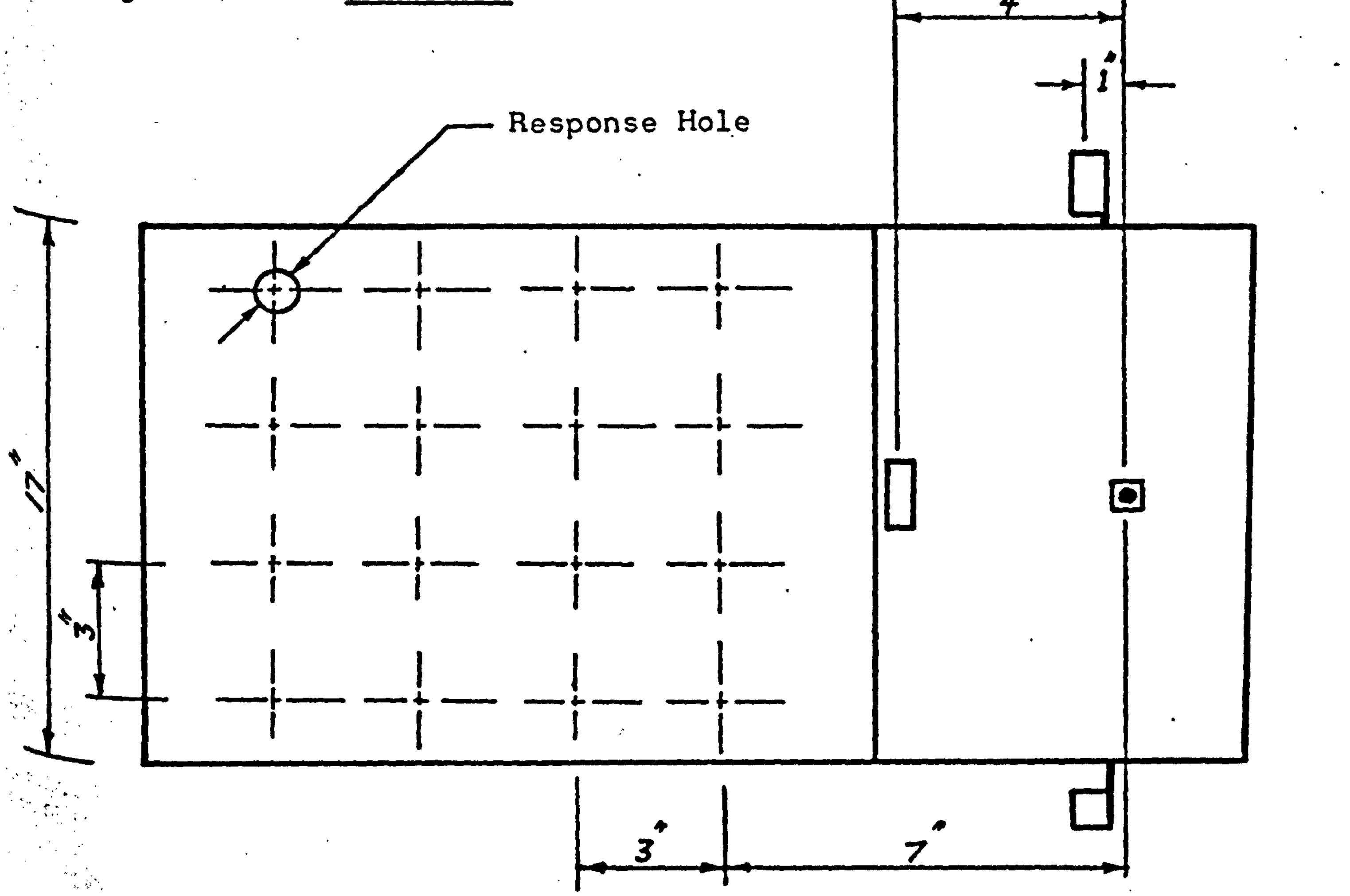


Figure (3.4). S-R Unit



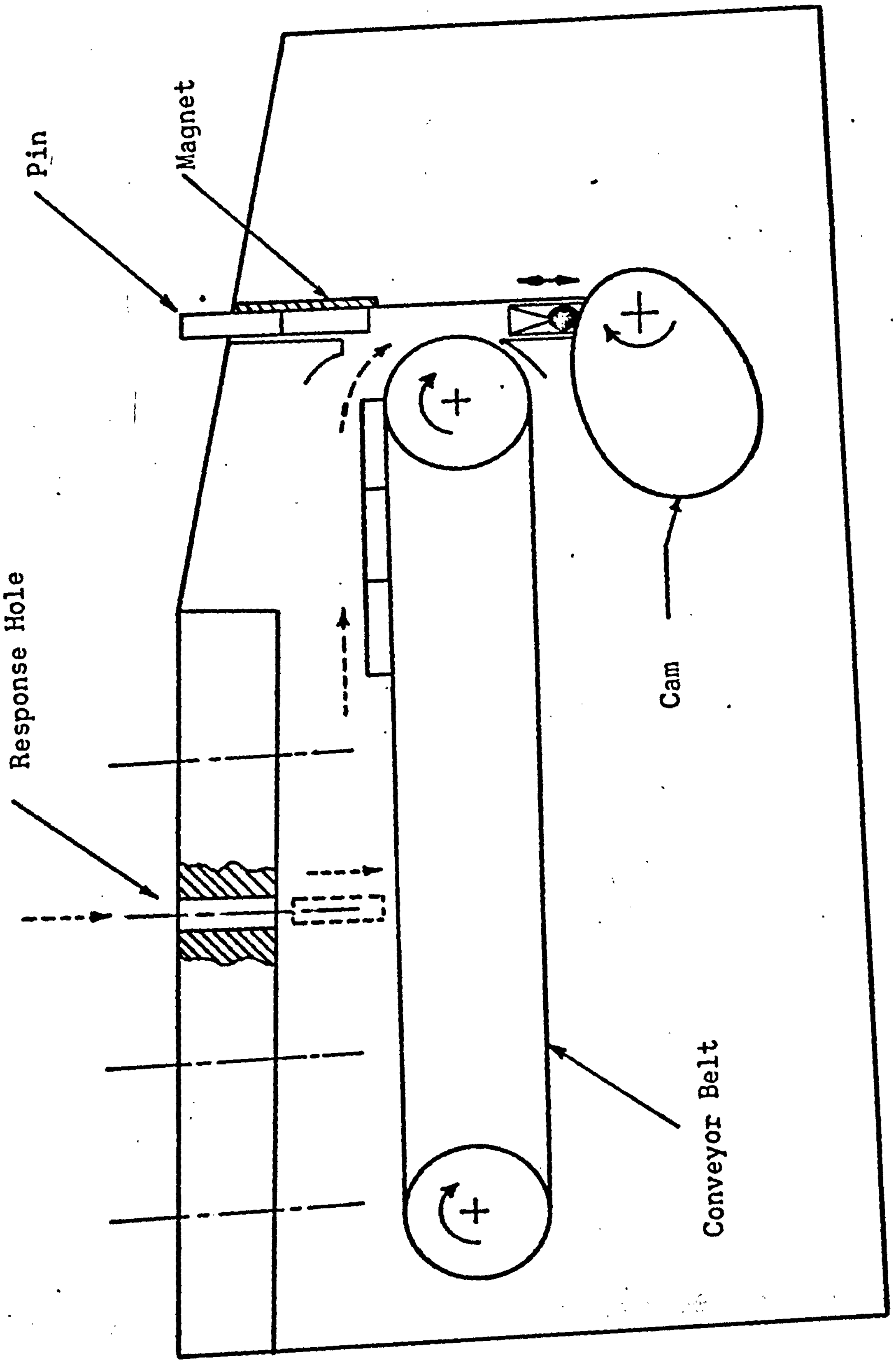


Figure (3.5). Pin System.

3.2.3 Experimental Runs

The information content of the task was varied by using 3 different levels of information load (H) and 4 levels of clearance (C) between the pin and the response hole as follows:

(i) Information load:

Level	Number of Holes	$H = \log_2 N$ bits
H2	4	2
H3	8	3
H4	16	4

(ii) Clearance:

C1 = 0.75"

C2 = 0.25"

C3 = 0.063"

C4 = 0.008"

The combination between the 3 levels of H and the 4 levels of C formed the 12 experimental runs as shown in table 3.3.

Table (3.3) Experimental Runs

Order of the run	Level of C	Level of H
1	C1	H2
2	C1	H3
3	C1	H4
4	C2	H2
5	C2	H3
6	C2	H4
7	C3	H2
8	C3	H3
9	C3	H4
10	C4	H2
11	C4	H3
12	C4	H4

CHAPTER IV

EXPERIMENTAL DESIGN

4.1 Experimental Models

Introduction:

In order to test the hypotheses in the present study, the following models were developed.

1. Decision time models.
2. Movement time models.
3. Performance errors model.
4. Heart rate model.

For both decision and movement time, two models each were developed. In the first model, the two elements of task difficulty, i.e. clearance and distance, were considered as separate independent variables in the model. In the second model, the two elements were combined into one term (index of difficulty ID) using Fitt's formula as explained earlier (Equation 2.1).

Decision time, movement time, performance errors and heart rate are defined as follows:

(a) Decision time:

This is defined as the time elapsed between the appearance of the stimulus and the beginning of the responding movement (Broadbent, 1958). It consists of:

(i) Occurrence of stimulus.

(ii) Detection of stimulus.

(iii) Decision.

(iv) Selection of response.

(b) Movement time:

This is defined as the time elapsed between the beginning of the responding movement to the completion of the movement.

(c) Performance errors:

There is only one type of performance error in this task, i.e. positioning the pin in the wrong hole. This error is presented as a percentage by dividing the number of errors by the total number of cycles in each experimental run.

(d) Heart rate:

This is the rate in beats per minute.

4.1.1 Decision Time Models

(i) First Model

A 2 x 10 x 3 x 4 x 4 mixed model, with both nesting and crossing arrangement was used to test the main effects and the interactive effects of the following factors on the decision time (see Figure 4.1).

(1) Age differences, G (fixed)

Two levels of age differences were used:

- First level, younger group (G1), was subjects with age between 18 and 29 years.
- Second level, older group (G2), was subjects with age between 52 and 63 years.

(2) Subjects, S (random)

Ten subjects in each age level participated in the study. Subjects were nested within the levels of factor (G).

(3) Information load, H (fixed)

Three levels of information load were used:

	Number of holes (N)	$H = \log_2 N$ bits
- First level (H2)	4	2
- Second level (H3)	8	3
- Third level (H4)	16	4

Studies by Scholes (1970) and Raouf and El-Sayed (1975) have indicated that small angular differences in the narrow region had negligible effects on performance time, and that the cross body movements had no effect on the performance time at any level of information load, distance and direction.

In light of the above findings, the different levels of information load are presented as follows:

The first level (H2) was represented by holes numbered 3, 7, 11 and 15; the second level (H3) by holes numbered 2, 3, 6, 7, 10, 11, 14 and 15; and the third level by using all 16 holes (Figures 4.2a and b). Special covers for the top plate of the S-R unit were designed and used for this purpose (see Figures 4.4a, b and c).

(4) Clearance, C (Fixed)

Four levels of clearance between the pin and the response hole were used:

C1 = 0.75"

C2 = 0.25"

C3 = 0.063"

C4 = 0.008"

(5) Distance, D (Fixed)

Four levels of distances between the pin-pocket and the response holes were used (Figure 4.3):

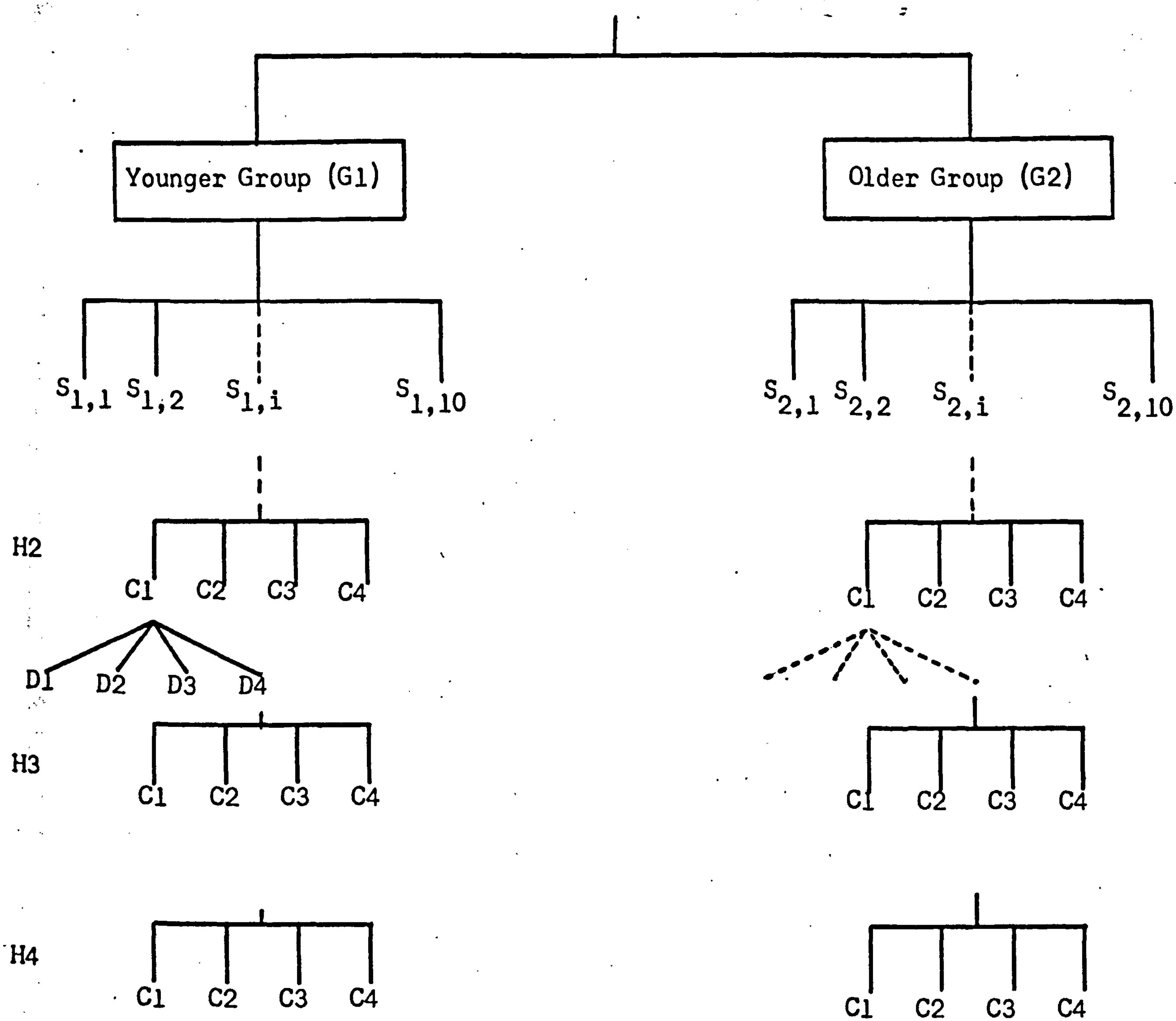
D1 = 7"

D2 = 10"

D3 = 13"

D4 = 16"

Figure (4.1). *__Experimental Conditions.__*



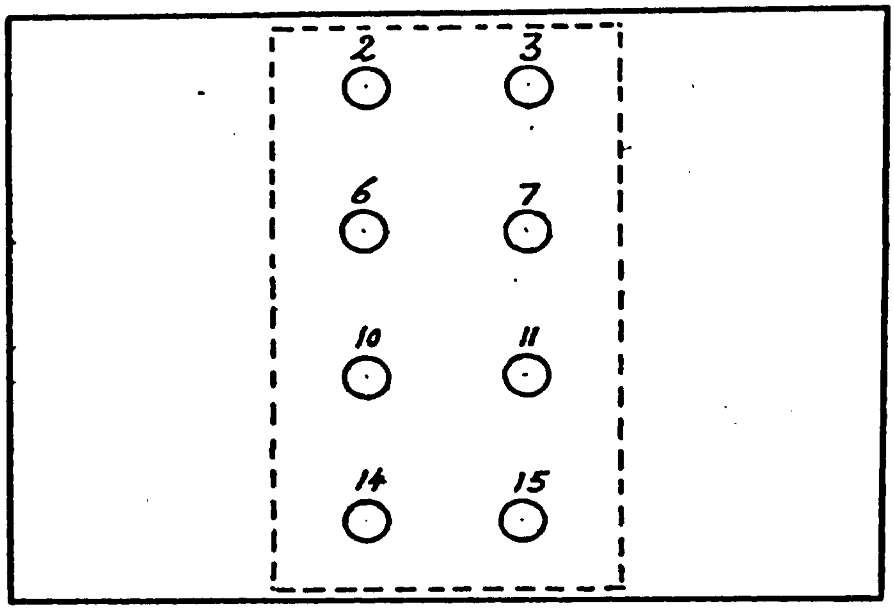


Figure (4.2a) Response Holes for the Second Level of Information Load. (H3).

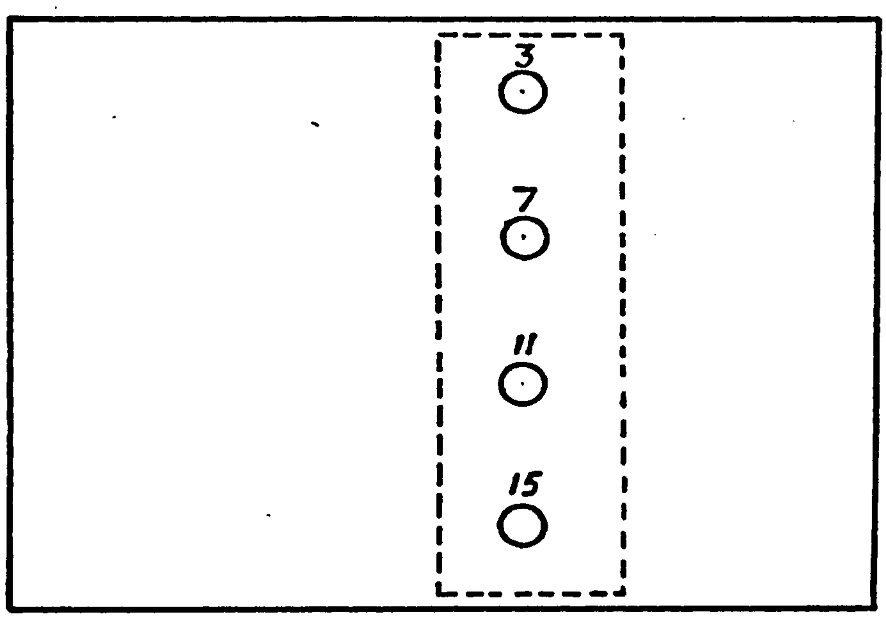


Figure (4.2b) Response Holes for the First Level of Information Load. (H2)

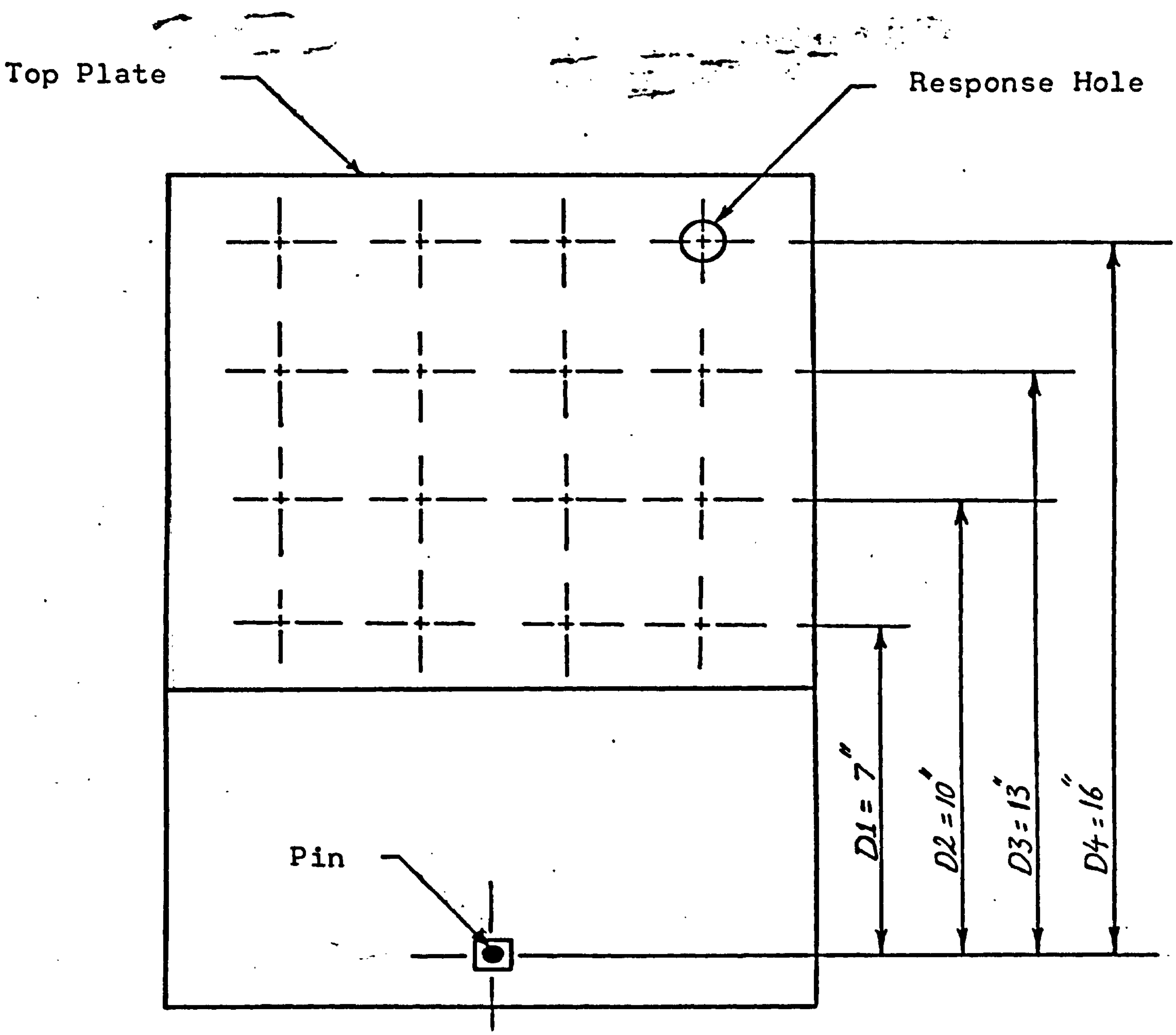


Figure (4.3). The Different Levels of Distances (D).

The Model

The model is:

$$
\begin{aligned}
Y_{ijk\ell m} = \mu &+ \alpha_i + \beta_{j(i)} + \gamma_k + \delta_\ell + \theta_m \\
&+ \alpha\gamma_{ik} + \alpha\delta_{i\ell} + \ldots . \\
&+ \beta\gamma_{jk(i)} + \beta\delta_{j\ell(i)} + \beta\theta_{jm(i)} \\
&+ \alpha\gamma\delta_{ik\ell} + \ldots . \\
&+ \beta\gamma\delta_{jk\ell(i)} + \ldots . \\
&+ \alpha\gamma\delta\theta_{ik\ell m} \\
&+ \beta\gamma\delta\theta_{jk\ell m(i)} + \varepsilon_{(ijk\ell m)} \qquad (4.1)
\end{aligned}
$$

where μ = general mean.

α_i = main effect of age.

$i = 1, 2$

$\beta_{j(i)}$ = Subjects nested within age.

$j = 1, \ldots, 10$

γ_k = main effect of information load.

$k = 1, 2, 3$

δ_ℓ = main effect of clearance.

$\ell = 1, \ldots, 4$.

θ_m = main effect of distance.

$m = 1, \ldots, 4$.

$\varepsilon_{(ijk\ell m)}$ = Residuals.

$Y_{ijk\ell m}$ = The mean decision time of the 40 observations for the m^{th} level of distances, ℓ^{th} level of clearance, k^{th} level of information load, j^{th} subject and i^{th} age group.

Note: In the above model, since all the main effects and all the interaction terms were included, there are no degrees of freedom left for the error term and the test of the main effects and the interactions were done using the interactions with the random factor (subjects) as an error term as explained in the next chapter.

(ii) Second Model

This is essentially the same as the first model except that the two factors, i.e. the clearance and the distance were combined into the index of difficulty term, using Fitts' formula (Table 4.1).

The Model

The second model of the decision time using the index of difficulty as an independent variable is:

$$\begin{aligned} Y_{ijkp} = \mu &+ \alpha_i + \beta_{j(i)} + \gamma_k + \eta_p \\ &+ \alpha\gamma_{ik} + \alpha\eta_{ip} + \gamma\eta_{kp} \\ &+ \beta\gamma_{jk(i)} + \beta\eta_{jp(i)} \\ &+ \alpha\gamma\eta_{ikp} \\ &+ \beta\gamma\eta_{jkp(i)} + \varepsilon_{(ijkp)} \end{aligned} \tag{4.2}$$

where η_p = main effect of the index of difficulty

$p = 1, \ldots, 16$

Y_{ijkp} = the mean decision time of the 40 observations of the p^{th} index of difficulty, k^{th} information load, j^{th} subject and i^{th} age group, μ, α, β and γ are the same as the first model.

Table (4.1)

Conversion of C and D into Index of Difficulty (ID)

C, D	ID= $\log_2 \frac{2D}{C}$ bits	Ranked levels of ID
C1D1	4.222	1
C1D2	4.737	2
C1D3	5.115	3
C1D4	5.415	4
C2D1	5.807	5
C2D2	6.322	6
C2D3	6.700	7
C2D4	7.00	8
C3D1	7.796	9
C3D2	8.310	10
C3D3	8.689	11
C3D4	8.989	12
C4D1	10.773	13
C4D2	11.288	14
C4D3	11.666	15
C4D4	11.966	16

4.1.2 Movement Time Models

(i) First Model

A 2 x 10 x 3 x 4 x 4 mixed model, with both nesting and crossing arrangements and with the same experimental factors as the first decision time model was used to test the main effects and the interactive effects on the movement time.

The model is:

$$\begin{aligned} Y'_{ijk\ell m} = \mu &+ \alpha_i + \beta_{j(i)} + \gamma_k + \delta_\ell + \theta_m \\ &+ \alpha_i\delta_\ell + \cdots \\ &+ \beta\gamma_{jk(i)} + \cdots \\ &+ \alpha\gamma\delta_{ik\ell} + \cdots \\ &+ \beta\gamma\delta_{jk\ell(i)} + \cdots \\ &+ \alpha\gamma\delta\theta_{ik\ell m} \\ &+ \beta\gamma\delta\theta_{ik\ell m(i)} + \varepsilon_{(ijk\ell m)} \end{aligned} \tag{4.3}$$

where

$Y'_{ijk\ell m}$ is the mean movement time of the 40 observations for the m^{th} level of distance; ℓ^{th} level of clearance, k^{th} level of information load, j^{th} subject and i^{th} age group.

μ , α , β , γ , δ , and θ are the same as in the first model for the decision time.

(ii) Second Model

This is essentially the same as the second model of the decision time. The clearance and the distance were combined into an index of difficulty term (ID) with 16 levels as shown in table 4.1, the model is:

$$Y'_{ijkp} = \mu + \alpha_i + \beta_{j(i)} + \gamma_k + \eta_p$$
$$+ \alpha\gamma_{ik} + \alpha\eta_{ip} + \gamma\eta_{kp}$$
$$+ \beta\gamma_{jk(i)} + \beta\eta_{jp(i)}$$
$$+ \alpha\gamma\eta_{ikp} + \beta\gamma\eta_{jkp(i)} + \varepsilon_{(ijkp)} \qquad (4.4)$$

where Y'_{ijkp} = mean movement time of the 40 observations for the p^{th} level of ID, k^{th} level of information load, j^{th} subject and i^{th} age group.

μ , α , β , γ and η are the same as in the second model of the decision time.

4.1.3 Performance Errors Model

A $2 \times 10 \times 3 \times 4$ mixed model was used to study the effect of age, clearance and information load and their interactive effects on the percentage of errors in the performance of the task. The model is:

$$
\begin{aligned}
X_{ijk\ell} = \mu &+ \alpha_i + \beta_{j(i)} + \gamma_k + \delta_\ell \\
&+ \alpha\gamma_{ik} + \alpha\delta_{i\ell} + \gamma\delta_{k\ell} \\
&+ \beta\gamma_{jk(i)} + \beta\delta_{j\ell(i)} \\
&+ \alpha\gamma\delta_{ik\ell} + \beta\gamma\delta_{jk\ell(i)} + \varepsilon_{(ijk\ell)} \qquad (4.5)
\end{aligned}
$$

where

$X_{ijk\ell}$ = the percentage of errors for the ℓ^{th} level of clearance, k^{th} level of information load, j^{th} subject and i^{th} age group

and μ, α, β, γ, δ are the same as in the previous models.

4.1.4 Heart Rate Model

A 2 x 10 x 3 x 2 mixed model was used to study the effect of age, clearance, and information load and their interactive effects on the percentage increase in the heart rate. The model is:

$$
\begin{aligned}
R_{ijkq} = {} & \mu + \alpha_i + \beta_{j(i)} + \gamma_k + \delta_q \\
& + \alpha\gamma_{ik} + \alpha\delta_{iq} + \gamma\delta_{kq} \\
& + \beta\gamma_{jk(i)} + \beta\delta_{j\ell(i)} \\
& + \alpha\gamma\delta_{ikq} + \beta\gamma\delta_{jkq(i)} + \epsilon_{ijkq} \qquad (4.6)
\end{aligned}
$$

where

R_{ijkq} = Percentage of heart rate increase at the q^{th} level of clearance, k^{th} level of information load, j^{th} subject and i^{th} age group,

δ_q = main effect of clearance (C)

$q = 1, 4$

and μ , α , β , γ are the same as in the previous models.

4.2 Experimental Procedure

Each subject, in both groups, performed the 12 experimental runs in a random order. The decision time, total performance time, and the hole number for each cycle were recorded. Concurrently, heart rate of the subject was recorded for six runs (run 1, 2, 3, 10, 11, and 12). These six runs have been chosen on the basis of including the easiest tasks (lowest index of difficulty at C = 0.75") and the most difficult tasks (highest index of difficulty at C = 0.008"). At the same time they cover the three levels of the information load (H2, H3, H4). Heart rate of each subject was also recorded at rest for five minutes, before the start of the experiment so as to obtain the "rest" rate.

Before starting the experiment, a brief description of the equipment set-up and also the purpose of the experiment was given to the subject. He was also advised to feel free to ask for a rest period if he felt that the assigned rest periods were not enough (see Appendix A). As it turned out, none of the subjects asked for a rest period.

Each subject was given a learning session at the beginning. This lasted for an hour including two rest periods of 5 minutes each and a rest period of 10 minutes at the end of the learning session. During the learning session, each subject performed approximately 1200 task cycles. It was found by Tsui (1977) that this figure was adequate for the learning of such a task. The task was performed using the 16 hole alternative and the smallest clearance (C4 = 0.008") since this combination was considered as being the most difficult.

The instructions to the subjects, the duration of the experimental conditions and the rest periods are explained in detail in Appendix A.

CHAPTER V

DATA ANALYSIS

For each subject, the performance time, the decision time and the response hole number for each cycle were recorded on the computer paper tape by the time measuring and recording unit. Data were then transferred to computer cards.

Data sets were sorted by group, subject, information load, clearance and distance using the SAS (Statistical Analysis System). Movement time for each cycle was computed from the observations for decision and performance time for each cycle. The mean $(\bar{x})$ and the standard deviation (s) for the data for each cell were computed. "Outliers", i.e. points beyond the $\pm 3\sigma$ range, were screened out and the number of errors per experimental run, i.e. under each level of information load and each level of clearance for each subject, were recorded. The duration of the experimental run (see Appendix A) allowed the collection of about 220 observations per run, i.e. 55 observations per cell at each of the 4 levels of distance. The first five observations in each cell were discarded to account for warm up effects for each new condition. Beginning with the 6th observation the next 40 observations were taken per cell. The remaining observations were discarded to account for any end-spurt effects.

Data were tested for normality using the SAS package KSLTEST procedure at the University of Windsor. The KSLTEST procedure involved the calculation of the mean and the standard deviation for each variable. Next the Kolmogrov statistic (D) is computed as:

$$D = \text{MAX}\,|S(X) - F(X)|$$

where S is the sample cumulative distribution function and F is the normal distribution function with the sample mean and variance. It was found that the data for the performance, decision, and movement time are distributed normally under each condition for each subject in both groups, at a level of significance of $\alpha = 0.01$. A sample of part of the results of the test for normality is listed in Appendix B .

5.1 Decision Time

The means of the decision time were calculated for the 40 observations of each cell (see Appendix C). These means were subjected to an analysis of variance using the two different models (Equations 4.1 and 4.2) discussed before.

5.1.1 The First Model

The first model (Equation 4.1) is a mixed model with the subjects as a random factor and all the other factors (age, information load, clearance, and distance) fixed. The expected mean square values [E(MS)] were calculated (Table 5.1) using the Cornfield and Tukey algorithm (see Winer, 1971) and used as an indicator of the appropriate F-ratios. From the E(MS) values (Table 5.1) it was found that the test on the main effect of G, H, C and D and the interaction between them (GxH, GxC, GxD, HxC, HxD, CxD, GxHxC, GxHxD, GxCxD and GxHxCxD) should be done using the interactions with the subjects within the group as error terms.

The analysis of variance was done using the SAS package (ANOVA PROCEDURE). The results of the analysis for the first model are summarized in Table 5.2.

Table 5.1 E(MS) Values: Decision Time (First Model)

Effect	Fixed I 2	R J 10	F K 3	F L 4	F M 4	N 1	E(MS)
Between Subjects							
G	0	10	3	4	4	1	$\sigma_R^2 + 48\sigma_S^2 + 480\sigma_G^2$
S(G)	1	1	3	4	4	1	$\sigma_R^2 + 48\sigma_S^2$
Within Subjects							
H	2	10	0	4	4	1	$\sigma_R^2 + 16\sigma_{SH}^2 + 320\sigma_H^2$
GxH	0	10	0	4	4	1	$\sigma_R^2 + 16\sigma_{SH}^2 + 160\sigma_{GH}^2$
HxS(G)	1	1	0	4	4	1	$\sigma_R^2 + 16\sigma_{SH}^2$
C	2	10	3	0	4	1	$\sigma_R^2 + 12\sigma_{SC}^2 + 240\sigma_C^2$
GxC	0	10	3	0	4	1	$\sigma_R^2 + 12\sigma_{SC}^2 + 120\sigma_{GC}^2$
CxS(G)	1	1	3	0	4	1	$\sigma_R^2 + 12\sigma_{SC}^2$
D	2	10	3	4	0	1	$\sigma_R^2 + 12\sigma_{SD}^2 + 240\sigma_D^2$
GxD	0	10	3	4	0	1	$\sigma_R^2 + 12\sigma_{SD}^2 + 12\sigma_{GD}^2$
DxS(G)	1	1	3	4	0	1	$\sigma_R^2 + 12\sigma_{SD}^2$
HxC	2	10	0	0	4	1	$\sigma_R^2 + 4\sigma_{SHC}^2 + 80\sigma_{HC}^2$
GxHxC	0	10	0	0	4	1	$\sigma_R^2 + 4\sigma_{SHC}^2 + 40\sigma_{GHC}^2$
HxCxS(G)	1	1	0	0	4	1	$\sigma_R^2 + 4\sigma_{SHC}^2$
HxD	2	10	0	4	0	1	$\sigma_R^2 + 4\sigma_{SHD}^2 + 80\sigma_{HD}^2$
GxHxD	0	10	0	4	0	1	$\sigma_R^2 + 4\sigma_{SHD}^2 + 40\sigma_{GHD}^2$
HxDxS(G)	1	1	0	4	0	1	$\sigma_R^2 + 4\sigma_{SHD}^2$
CxD	2	10	3	0	0	1	$\sigma_R^2 + 3\sigma_{SCD}^2 + 60\sigma_{CD}^2$
GxCxD	0	10	3	0	0	1	$\sigma_R^2 + 3\sigma_{SCD}^2 + 30\sigma_{GCD}^2$
CxDxS(G)	1	1	3	0	0	1	$\sigma_R^2 + 3\sigma_{SCD}^2$
HxCxD	2	10	0	0	0	1	$\sigma_R^2 + \sigma_{SHCD}^2 + 20\sigma_{HCD}^2$
GxHxCxD	0	10	0	0	0	1	$\sigma_R^2 + \sigma_{SHCD}^2 + 10\sigma_{GHCD}^2$
HxCxDxS(G)	1	1	0	0	0	1	$\sigma_R^2 + \sigma_{SHCD}^2$
R	1	1	1	1	1	1	σ_R^2

Table 5.2 ANOVA For Decision Time Model (First Model)

Source	d.f.	MS	F	F critical
<u>Between Subjects</u>				
G	1	17511724.3	30.01*	4.41
S(G)	18	583475.1		
<u>Within Subjects</u>				
H	2	4890592.0	133.22*	3.27
GxH	2	220306.5	6.00*	3.27
HxS(G)	36	36711.4		
C	3	37550.3	1.28	2.78
GxC	3	7653.0	0.26	2.78
CxS(G)	54	29300.6		
D	3	13172.3	7.05*	2.78
GxD	3	3201.0	1.71	2.78
DxS(G)	54	1867.2		
HxC	6	19472.2	1.22	2.18
GxHxC	6	23307.3	1.46	2.18
HxCxS(G)	108	15983.9		
HxD	6	8765.0	5.73*	2.18
GxHxD	6	1490.5	0.97	2.18
HxDxS(G)	108	1529.6		
CxD	9	462.0	0.43	1.94
GxCxD	9	352.0	0.32	1.94
CxDxS(G)	162	1086.0		
HxCxD	18	982.6	1.15	1.61
GxHxCxD	18	1190.8	1.39	1.61
HxCxDxS(G)	324	855.0		

* Effect is significant at $\alpha = 0.05$

5.1.1.1 Test on Homogeneity of Interactions with Subjects

Since homogeneity is one of the assumptions made when the F-ratio is considered to be distributed in the form of F-distribution, a test on homogeneity of the interactions with subject was needed. Bartlett's test was used for this purpose. Results are presented in Appendix E.

Since the observed value for Chi square (902.4) exceeds the critical value (14.1) for a test with $\alpha = 0.05$, the test indicates that the interactions should not be pooled. Equivalently, the test indicates that interactions with subjects should not be dropped from the model.

5.1.1.2 Analysis of the Main Effects

The analysis of the main effects of the independent variables (G, H, C and D) was done by a test on the difference between all possible pairs of means of DT on only the significant main effects. In the first decision time model the main effects of age (G), information load (H), and distance (D) were significant. The mean of the decision time at each level of these factors are as in tables 5.3, 5.4 and 5.5.

Table 5.3

Means of DT at the Two Levels of G.

Levels of G	Means of DT (milliseconds)
G1 (Young)	427.6
G2 (Old)	697.7

Table 5.4

Means of DT at the Three Levels of H.

Levels of H	Means of DT (milliseconds)
H2 = 2 bits	439.4
H3 = 3 bits	561.8
H4 = 4 bits	686.7

Table 5.5

Means of DT at the Four Levels of D.

Levels of D	Means of DT (milliseconds)
D1 = 7"	552.9
D2 = 10"	565.9
D3 = 13"	570.3
D4 = 16"	561.2

(a) Test on the difference between all possible pairs of means at the 3 levels of H

Since factor H is within-subjects effects, the standard error of the differences of the means for all observations at a given level of factor H is

$$S_{\bar{H}} = \sqrt{\frac{MS_{HxS(G)}}{IJLM}} = \sqrt{\frac{36711.4}{320}} = 10.71 .$$

	H2	H3	H4	r	$S_{\bar{H}} \times q_{.95,r,36}$
H2		122.4*	247.2*	3	36.95
H3			124.8*	2	30.73

* Difference is significant at $\alpha = 0.05$

From the above table it is found that the differences between all possible pairs of means at the 3 levels of H are significant.

(b) Test on the difference between all possible pairs of means at the 4 levels of D

$$S_{\bar{D}} = \sqrt{\frac{MS_{DxS(G)}}{IJKL}} = \sqrt{\frac{1867.2}{240}} = 2.79$$

	D1	D4	D2	D3	r	$MS_{\bar{D}} \times q_{.95,r,54}$
D1		8.25	12.92*	17.33*	4	10.49
D4			4.66	9.07	3	9.51
D2				4.41	2	7.89

* Difference is significant at $\alpha = 0.05$

From the above table it is found that there is a significant difference between the means at D1 and D2 and between the means at D1 and D3.

5.1.1.3 Analysis of the Interactions

Analysis of the interactions was done in order to investigate the interactive effects of the independent variables on the decision time. The analysis was done for these significant interactions only. Table 5.2 shows that the interactions between age and information load (GxH) and between information load and distance (HxD) were the only significant interactions. The means of DT at each level of H for both levels of G are summarized in table 5.6 and the mean of DT at each level of H for each level of D are summarized in table 5.7. Tables 5.6 and 5.7 are also presented graphically in figures 5.1 and 5.2.

levels of H \ levels of G	G1	G2
H2	328.3	550.5
H3	430.8	692.7
H4	523.5	849.8

Table 5.6. Means of DT (in milliseconds) at the 3 levels of H and the 2 levels of G .

levels of H \ levels of D	D1	D2	D3	D4
H2	442.6	437.0	441.4	436.6
H3	555.3	561.0	568.7	562.1
H4	661.0	699.8	700.8	685.0

Table 5.7. Means of DT (in milliseconds) at the 3 levels of H and the 4 levels of D .

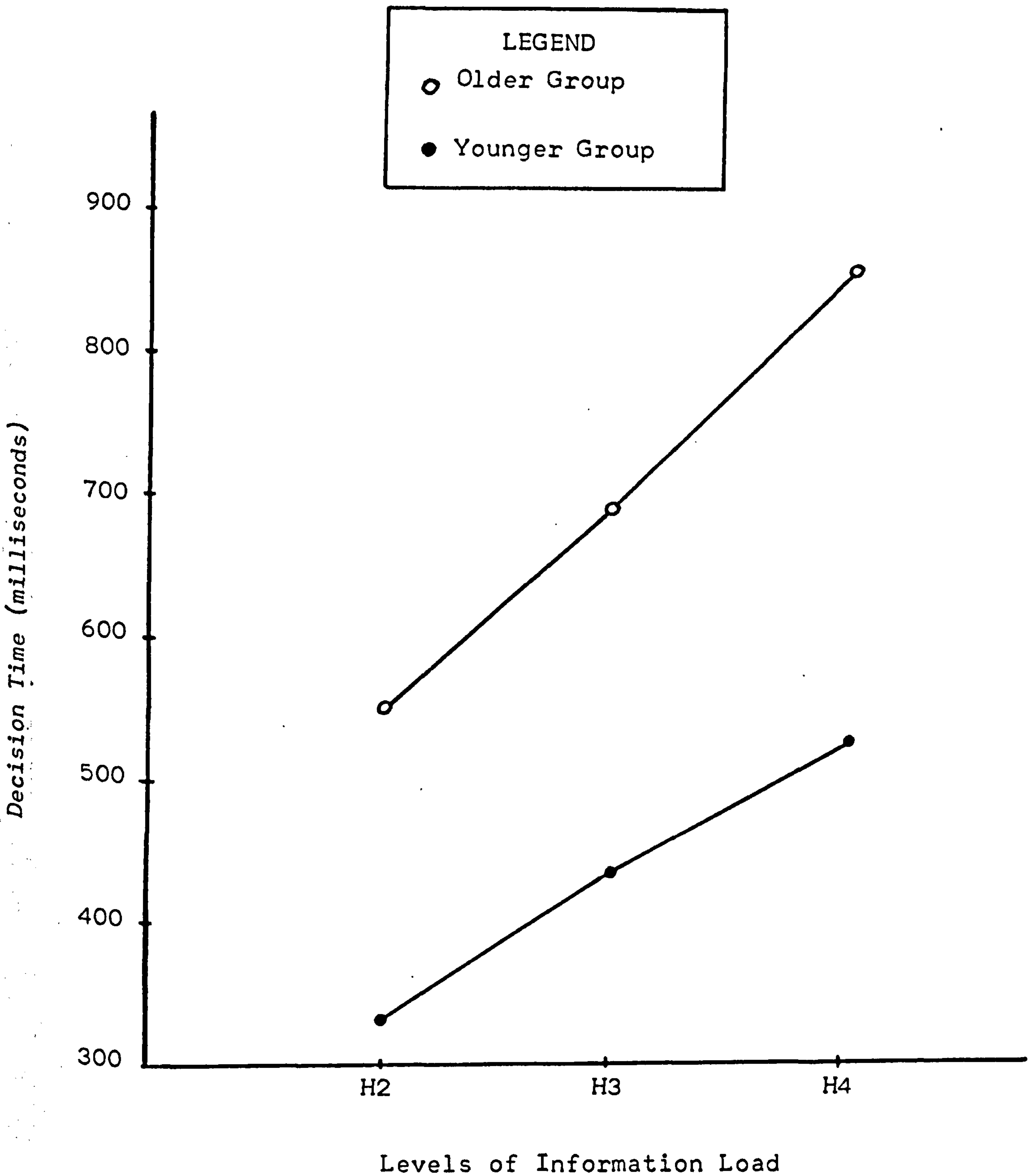


Figure (5.1). Effect of Information Load on Decision Time.

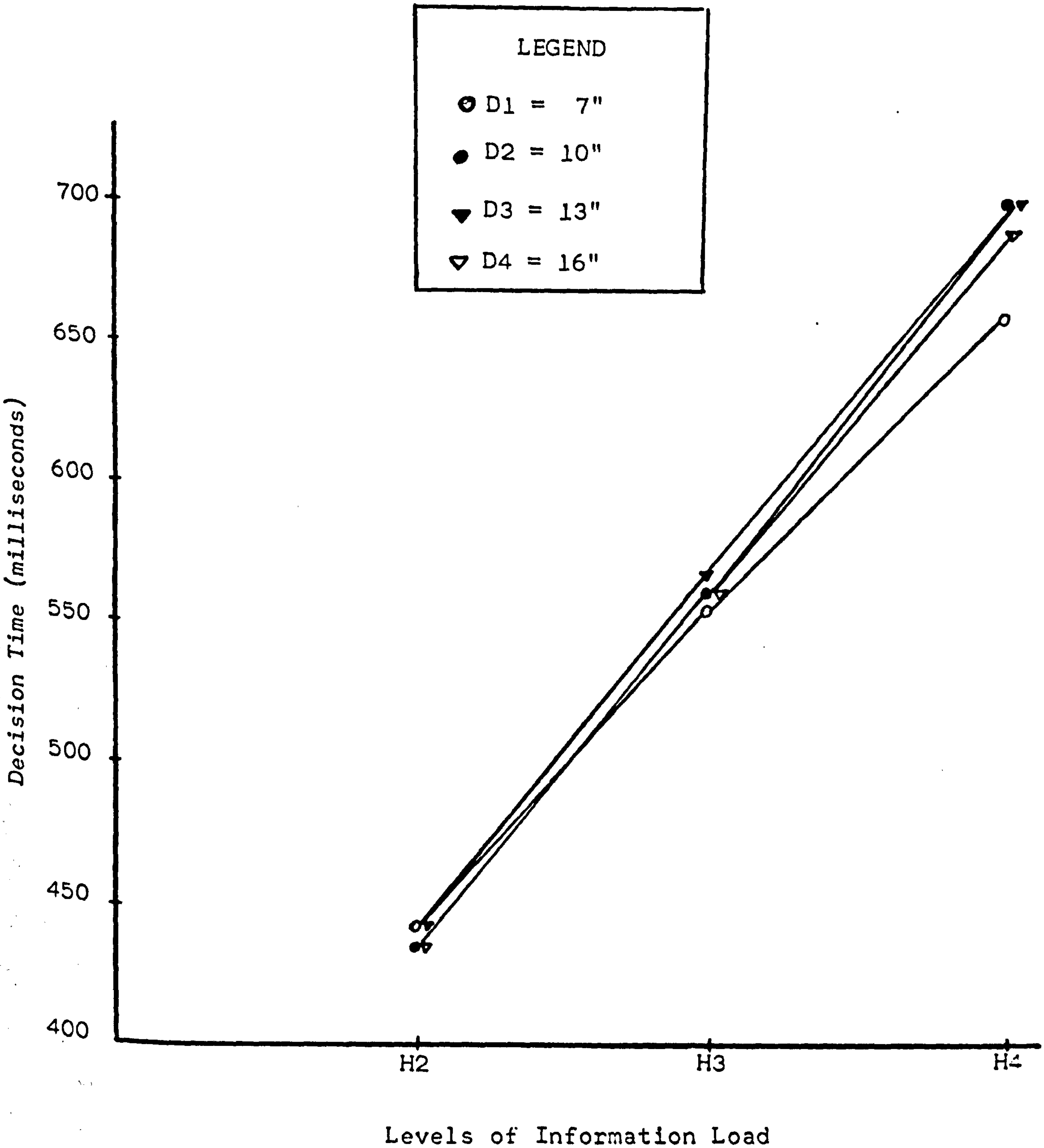


Figure (5.2). Effect of Information Load on Decision Time at Different Levels of Distances.

The interaction between age (G) and clearance (C) was not significant nor was the interaction between age and distance (D). These interactions are presented graphically by plotting the mean of DT at the 4 levels of C for both age groups (Figure 5.3) and at the 4 levels of D for both age groups (Figure 5.4).

(A) Interactions between age and information load (GxH).

The analysis of the interaction between G and H was done in two steps:

Step 1: test on simple main effect of H at each level of G

Step 2: test on differences between pairs of mean of the decision time at each level of information load.

Step 1

F-ratio, for testing the simple main effect of H, has the form

$$F = \frac{MS_{H \text{ at } Gi}}{MS_{HxS(G)}} \qquad i = 1, 2$$

(a) Test at G1 level.

$$F = \frac{MS_{H \text{ at } G1}}{MS_{HxS(G)}} = \frac{3052542/2}{1321610/36} = 41$$

$$F_{0.05,2,36} = 3.36$$

The observed value (F=41) exceeds the critical value ($F_{.05,2,36}=3.36$); therefore, the simple main effect of H at G1 is significant, and a test on the difference between all possible pairs of means of DT at the three levels of H is needed. Newman-Keuls' method was used for this test:

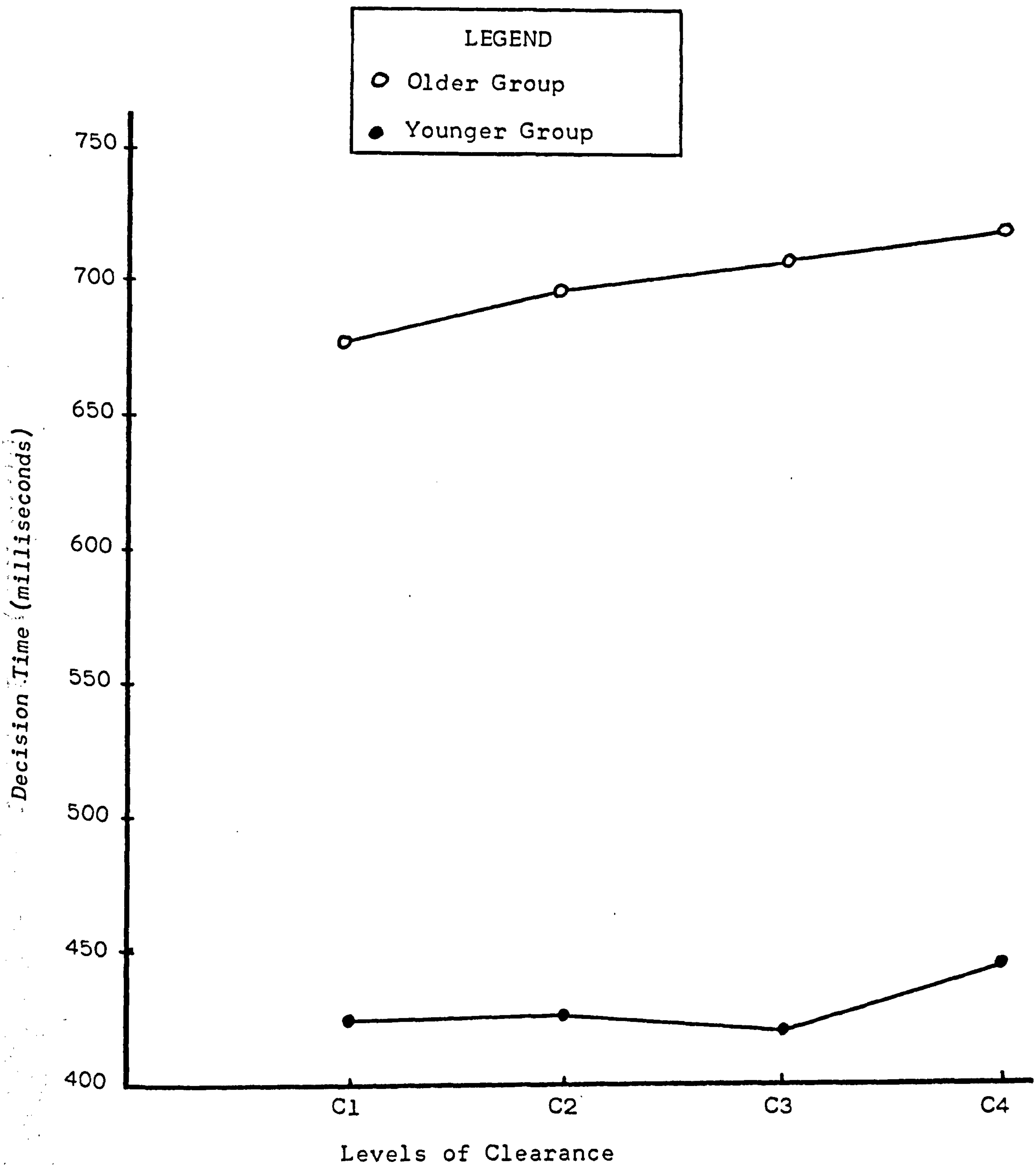


Figure (5.3). Effect of Clearance on Decision Time.

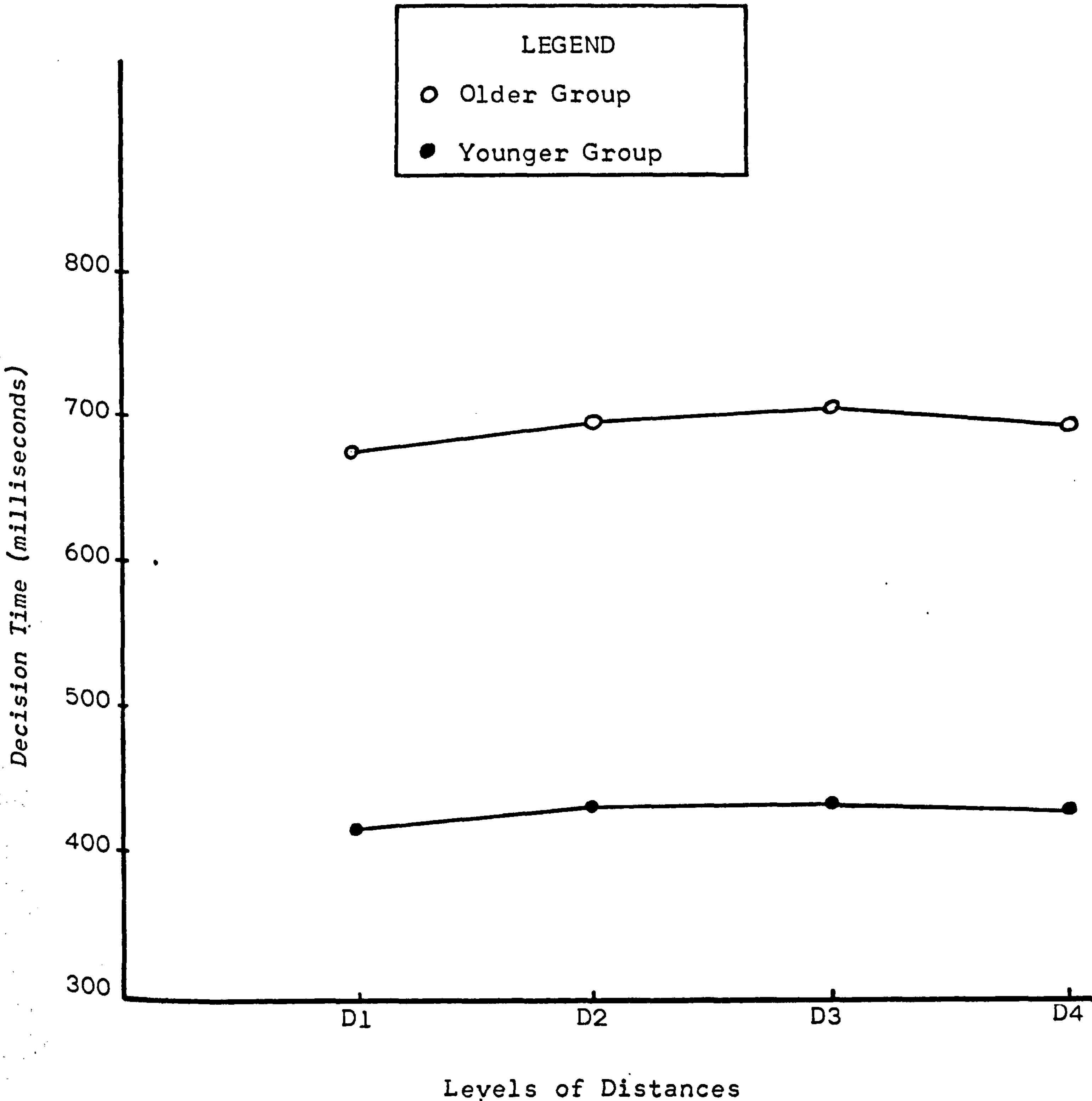


Figure (5.4). Effect of Distance on Decision Time.

The standard error =

$$S_{\overline{HG}} = \sqrt{2MS_{HxS(G)}|JLM}$$

$$MS_{HxS(G)} = 36711.4$$

$$J = 10 \qquad M = 4 \qquad L = 4$$

$$S_{\overline{HG}} = \sqrt{2x36711.4/160} = 21.42$$

	H2	H3	H4	r	$S_{\overline{HG}} \times q_{.95,r,36}$
H2		102*	195*	3	74.11
H3			93*	2	61.4

*difference is significant at $\alpha = 0.05$

From the above table we find that the difference between all the possible pairs of means is significant.

(b) Test at G2 level.

$$F = \frac{MS_{H\ at\ G2}}{MS_{HxS(G)}} = \frac{7169256/2}{1321610/36} = 97.6 \ .$$

The observed value (F=97.6) exceeds the critical value ($F_{.05,2,36}=3.36$); therefore, the simple main effect of H at G2 is significant. Newman-Keul's method was used to test the difference between all the possible pairs of means of DT at the three levels of H .

The standard error $S_{\overline{HG}} = 21.42$

	H2	H3	H4	r	$S_{\overline{HG}} \times q_{.05,r,36}$
H2		142*	299*	3	74.11
H3			157*	2	61.4

*difference is significant at $\alpha = 0.05$

From the above table we find that the difference between all possible pairs of means is significant.

Step 2. (Test on the difference between means of DT at each level of H)

The standard error for test $\overline{GH}_{2j} - \overline{GH}_{1j}$, where $\overline{GH}_{1j}$ is the mean of the DT for the first group (G1) at the jth level of H and $\overline{GH}_{2j}$ is the mean of DT for the second group (G2) at the jth level of H, is:

$$S_{GH} = \sqrt{\frac{2(SS_{S(G)} + SS_{HxS(G)})}{JLM[(I(J-1) + I(J-1)(K-1)]}}$$

$$= \sqrt{\frac{2(10502553 + 1321610}{10x4x4(18+36)}} = 52.32 .$$

The critical value $= 52.32 \times q_{0.95,(2,54)}$

$= 52.32 \times 2.84 = 148.58$

(i) $\overline{GH}_{22} - \overline{GH}_{12} = 550.5 - 328.3 = 222.2$

(ii) $\overline{GH}_{23} - \overline{GH}_{13} = 692.7 - 430.8 = 261.9$

(iii) $\overline{GH}_{24} - \overline{GH}_{14} = 849.8 - 523.5 = 316.3$

Therefore all the differences are significant at $\alpha = 0.05$.

(B) <u>Interaction between information load and distance (HxD)</u>

The analysis of the interaction between H and D was done as follows:

Step 1: test on the simple main effect of D at each level of H .

Step 2: test on the difference between pairs of means of the decision time at the 3 levels of H for each level of D .

Step 1

$$F = \frac{MS_{D\text{ at }HK}}{MS_{DxS(G)}}\text{, where } K = 2,3,4$$

(a) Test on simple main effect of D at H2

$SS_{D\text{ at }H2} = 2225.29$

$SS_{DxS(G)} = 100828.068$

$$F = \frac{2225.29/3}{100828.068/54} = 0.397$$

(b) Test on simple main effect of D at H3

$SS_{D\text{ at }H3} = 7236.2$

$$F = \frac{7236.2/3}{100828.068/54} = 1.29$$

(c) Test on simple main effect of D at H4

$SS_{D\text{ at }H4} = 82645.22$

$$F = \frac{82645.22/3}{100828.068/54} = 14.75$$

Summary of the results of step 1

Effect	F	$F_{0.05,3,54}$
Main effect of D at H2	0.397	2.78
Main effect of D at H3	1.29	
Main effect of D at H4	14.75*	

*Significant at $\alpha = 0.05$

Since the main effect of D at H4 is significant, a test on the difference between all possible means of the decision time for the different levels of D at level of H = 4 bits is needed. The Newman-Keul's method was used to test these differences:

The standard error = $S_{\overline{HD}} = \sqrt{2MS_{HxDxS(G)}/IJL}$

where I = 2

J = 10

L = 4

$$\therefore S_{\overline{HD}} = \sqrt{2 \times 1592.6/80}$$

$$= 6.31 .$$

	D1	D4	D2	D3	r	$MS_{\overline{HD}} \times q_{.05,r,54}$
D1		24.04*	38.75*	39.82*	4	23.72
D4			14.7	15.78	3	21.52
D2				1.07	2	17.92

*difference is significant at α = 0.05

From the above table we find that the only significant differences are between D1 and D2, between D1 and D3 and between D1 and D4.

Step 2

(a) Test on the difference between means of the DT at the 3 levels of H at D1 .

(i) $\overline{HD}_{31} - \overline{HD}_{21}$

where $\overline{HD}_{31}$ is the mean at H3 and D1, and $\overline{HD}_{21}$ is the mean at H2 and D1.

$$t = \frac{\overline{HD}_{31} - \overline{HD}_{21}}{\sqrt{2\left[MS_{HxS(G)} + (M-1)(MS_{DxS(G)})\right]/IJLM}}$$

$$= \frac{555.3 - 442.6}{\sqrt{2\left[36711.4 + 3x1867.2\right]/320}} = \frac{112.721}{16.262}$$

$$= 6.93^{*}$$

the critical value for this test is as follows:

$$\text{t-critical} = \frac{t_H MS_{HxS(G)} + t_{D(M-1)} MS_{DxS(G)}}{MS_{HxS(G)} + (M-1) MS_{DxS(G)}} \qquad \text{(Winer 1971)}$$

where

t_H and t_D are the critical values for a test of level of significance $\alpha = .05$ for the degree of freedom corresponding to $MS_{HxS(G)}$ and $MS_{DxS(G)}$ respectively.

$t_H = 2.03$

$t_D = 2.004$

$\therefore$ $t_{critical} = 2.027$ at $\alpha = 0.05$

The observed t is greater than the critical value; therefore, the difference is significant.

(ii) $\overline{HD}_{41} - \overline{HD}_{31}$

$$t = \frac{661.0 - 555.3}{16.262} = 6.497$$

(b) <u>Test on the differences between means of DT at the 3 levels of H at D2</u> .

(i) $\overline{HD}_{32} - \overline{HD}_{22}$

$$t = \frac{560.9 - 436.9}{16.262} = 7.62$$

(ii) $\overline{HD}_{42} - \overline{HD}_{32}$

$$t = \frac{699.8 - 560.9}{16.262} = 8.53$$

(c) <u>Test on the difference between means of DT at the 3 levels of H at D3.</u>

(i) $\overline{HD}_{33} - \overline{HD}_{23}$

$$t = \frac{568.7 - 441.4}{16.262} = 7.83$$

(ii) $\overline{HD}_{43} - \overline{HD}_{33}$

$$t = \frac{700.8 - 568.7}{16.262} = 8.12$$

(d) <u>Test on the difference between means of DT at the 3 levels of H at D4.</u>

(i) $\overline{HD}_{34} - \overline{HD}_{24}$

$$t = \frac{562.1 - 436.6}{16.262} = 7.71$$

(ii) $\overline{HD}_{44} - \overline{HD}_{34}$

$$t = \frac{685.0 - 562.1}{16.262} = 7.56$$

Summary of the results of step 2

Difference	t	$t_{critical}$
$\overline{HD}_{31} - \overline{HD}_{21}$	6.93*	2.027
$\overline{HD}_{41} - \overline{HD}_{31}$	6.497*	
$\overline{HD}_{32} - \overline{HD}_{22}$	7.62*	
$\overline{HD}_{42} - \overline{HD}_{32}$	8.53*	
$\overline{HD}_{33} - \overline{HD}_{23}$	7.83*	
$\overline{HD}_{43} - \overline{HD}_{33}$	8.12*	
$\overline{HD}_{34} - \overline{HD}_{24}$	7.71*	
$\overline{HD}_{44} - \overline{HD}_{34}$	7.56*	

*Difference is significant at $\alpha = 0.01$

5.1.2 The Second Model

The second model (equation 4.2) is a mixed model with only the subjects as a random factor and all other factors (age, information load, and index of difficulty) fixed. The E(MS) values were calculated (table 5.8) as an indicator of the appropriate F-ratios.

The analysis of variance was done using SAS package (ANOVA PROCEDURE). The results of the analysis of variance for the second model are summarized in table 5.9.

Table 5.8 E(MS) Values: Decision Time (Second Model)

Effect	F I 2	R J 10	F K 3	F P 16	F N 1	E(MS)
Between Subjects						
G	0	10	3	16	1	$\sigma_R^2 + 48\sigma_S^2 + 480\sigma_G^2$
S(G)	1	1	3	16	1	$\sigma_R^2 + 48\sigma_S^2$
Within Subjects						
H	2	10	0	16	1	$\sigma_R^2 + 16\sigma_{HS}^2 + 320\sigma_H^2$
GxH	0	10	0	16	1	$\sigma_R^2 + 16\sigma_{HS}^2 + 160\sigma_{GH}^2$
HxS(G)	1	1	0	16	1	$\sigma_R^2 + 16\sigma_{HS}^2$
ID	2	10	3	0	1	$\sigma_R^2 + 3\sigma_{IDS}^2 + 60\sigma_{ID}^2$
GxID	0	10	3	0	1	$\sigma_R^2 + 3\sigma_{IDS}^2 + 30\sigma_{GID}^2$
IDxS(G)	1	1	3	0	1	$\sigma_R^2 + 3\sigma_{IDS}^2$
HxID	2	10	0	0	1	$\sigma_R^2 + \sigma_{HIDS}^2 + 20\sigma_{HID}^2$
GxHxID	0	10	0	0	1	$\sigma_R^2 + \sigma_{HIDS}^2 + 10\sigma_{GHID}^2$
HxIDxS(G)	1	1	0	0	1	$\sigma_R^2 + \sigma_{HIDS}^2$
R	1	1	1	1	1	σ_R^2

Table 5.9 ANOVA for the Decision Time Model (Second Model)

Source	d.f.	MS	F	$F_{critical}$
Between Subjects				
G	1	17511724.3	30.1*	4.41
S(G)	18	583475.1		
Within Subjects				
H	2	4890592.0	133.22*	3.27
GxH	2	220306.5	6.00*	3.27
HxS(G)	36	36711.4		
ID	15	10421.8	1.51	1.8
GxID	15	2382.0	0.35	1.8
IDxS(G)	270	6885.2		
HxID	30	6237.0	1.55*	1.46
GxHxID	30	5674.1	1.41	1.46
HxIDxS(G)	540	4015.7		

*Significant at $\alpha = 0.05$

5.2 Movement Time

The means of the movement time were calculated for the 40 observations of each cell (see Appendix C). These means were subjected to an analysis of variance using the two different models (Equation 4.3 and 4.4) discussed before.

5.2.1 The First Model

The first movement time model (Equation 4.3) is a mixed model with only the subjects as random factor and all the other factors (age, information load, clearance, and distance) fixed. Since the experimental factors were all the same as in the first decision time model, there was no need to recalculate the E(MS) values. The E(MS) values of the first DT Model (Table 5.1) were used as an indicator of the appropriate F-ratios.

The analysis of variance was done using the SAS package (ANOVA PROCEDURE). The results of the analysis of variance are summarized in Table 5.10.

Table 5.10 ANOVA for the Movement Time (First Model)

Source	d.f	MS	F	F critical
Between Subjects				
G	1	5192493.9	12.74*	4.41
S(G)	18	407639.5		
Within Subjects				
H	2	34717.5	3.72*	3.27
GxH	2	22912	2.54	3.27
HxS(G)	36	9339.6		
C	3	1054120	52.76*	2.78
GxC	3	23386	1.17	2.78
CxS(G)	54	19980.3		
D	3	1247390	152*	2.78
GxD	3	738.2	0.09	2.78
DxS(G)	54	9154.7		
HxC	6	5634.7	0.61	2.18
GxHxC	6	9025.3	0.98	2.18
HxCxS(G)	108	9211.0		
HxD	6	23163	9.84*	2.18
GxHxD	6	1824.8	0.78	2.18
HxDxS(G)	108	2353.2		
CxD	9	3739.5	2.01*	1.94
GxCxD	9	1070.7	0.58	1.94
CxDxS(G)	162	1857.7		
HxCxD	18	2025.5	1.47	1.61
GxHxCxD	18	1537.6	1.12	1.61
HxCxDxS(G)	324			

*Effect is significant at $\alpha = 0.05$

5.2.1.1 Test on Homogeneity of Interactions with Subjects

Test on homogeneity of interactions with subjects was done using Bartlett's test. Results are presented in Appendix E. Since the observed Chi square (352) exceeds the critical value (14.1) for a test with $\alpha = 0.05$, the test indicates that the interactions should not be pooled. Equivalently, the test indicates that interactions with subjects should not be dropped from the model.

5.2.1.2 Analysis of the Main Effects

The analysis of the main effects of the independent variables (G, H, C, and D) was done by test on the difference between all possible pairs of means of MT on only the significant main effects. In the first movement time model, the main effect of age (G), information load (H), clearance (C) and distance (D) were significant. The mean of the movement time at each level of these factors are as in Tables 5.11, 5.12, 5.13 and 5.14 respectively.

Table 5.11

Means of MT at the Two Levels of G .

levels of G	Means of MT (milliseconds)
G1 (Young)	676.8
G2 (Old)	823.9

Table 5.12

Means of MT at the Three Levels of H .

levels of H	Means of MT (milliseconds)
H2 = 2 bits	740.3
H3 = 3 bits	749.7
H4 = 4 bits	761.1

Table 5.13

Means of MT at the Four Levels of C .

levels of C	Means of MT (milliseconds)
C1 = .75"	710.7
C2 = .25"	694.8
C3 = 0.063"	753.3
C4 = 0.008"	842.6

Table 5.14

Means of MT at the Four Levels of D .

levels of D	Means of MT (milliseconds)
D1 = 7"	662.9
D2 = 10"	725.5
D3 = 13"	783.9
D4 = 16"	829.1

(a) Test on the difference between all possible pairs of means at the 3 levels of H .

The standard error of the mean for all observations at a given level of factor H is:

$$S_{\overline{H}} = \sqrt{\frac{MS_{HxS(G)}}{IJLM}}$$

I = 2 J = 10 L = 4 M = 4

$$\therefore \quad S_{\overline{H}} = \sqrt{\frac{9339.6}{320}} = 5.4$$

	H2	H3	H4	r	$S_{\overline{H}} \times q_{.95,r,36}$
H2		9.4	20.8*	3	18.7
H3			11.4	2	15.3

*Significant at $\alpha = 0.05$

From the above table we find that the only significant difference is between H2 and H4.

(b) Test on difference between all possible pairs of means at the 4 levels of C :

The standard error of the mean for all observations at a given level of factor C is:

$$S_{\overline{C}} = \sqrt{\frac{MS_{CxS(G)}}{IJKM}} = \sqrt{\frac{19980.3}{240}}$$

$$= 9.10$$

	C2	C1	C3	C4	r	$S_{\overline{C}} \times q_{0.05,r,54}$
C2		15.9	58.5*	147.9*	4	34.21
C1			42.6*	131.9*	3	31.03
C3				89.3*	2	25.84

*Difference is significant at $\alpha = 0.05$

From the above table it is found that the difference between all possible pairs of means are significant except those between C1 and C2.

(c) <u>Test on difference between all possible pairs of means at the 4 levels of D</u>.

The standard error of the mean for all observations at a given level of factor D is:

$$S_{\overline{D}} = \sqrt{\frac{MS_{DxS(G)}}{IJKL}} = \sqrt{\frac{8154.7}{240}} = 5.829$$

	D1	D2	D3	D4	r	$S_{\overline{D}} \times q_{0.05,r,54}$
D1		62.50*	121.00*	166.17*	4	21.917
D2			58.5*	103.66*	3	19.88
D3				45.166*	2	16.55

*Difference is significant at $\alpha = 0.05$

From the above table it is found that the difference between all possible pairs of means at the 4 levels of D are significant.

5.2.1.3 Analysis of the Interactions

Analysis of the interactions was done in order to investigate the interactive effect of the independent variables on the movement time. The analysis was done for the significant interactions only. Table 5.10 shows that the interactions between information load and distance (HxD) and between clearance and distance (CxD) were the only significant interactions. The means of MT at each level of H for each level of D are summarized in Table 5.15, and the means of MT at each level of C for each level of D are summarized in table 5.16. Tables 5.15 and 5.16 are also presented graphically in figures 5.5 and 5.6.

levels of D \ levels of H	H2	H3	H4
D1	644.1	666.8	678.0
D2	699.8	720.0	756.6
D3	783.4	775.9	792.5
D4	834.0	836.0	817.3

Table 5.15 Means of MT at the 3 levels of H and the 4 levels of D .

levels of D \ levels of C	C1	C2	C3	C4
D1	620.1	608.9	661.1	761.8
D2	693.7	672.3	726.8	809.2
D3	748.3	732.3	783.8	871.4
D4	780.8	765.8	841.7	928.2

Table 5.16 Means of MT at the 4 levels of C and the 4 levels of D .

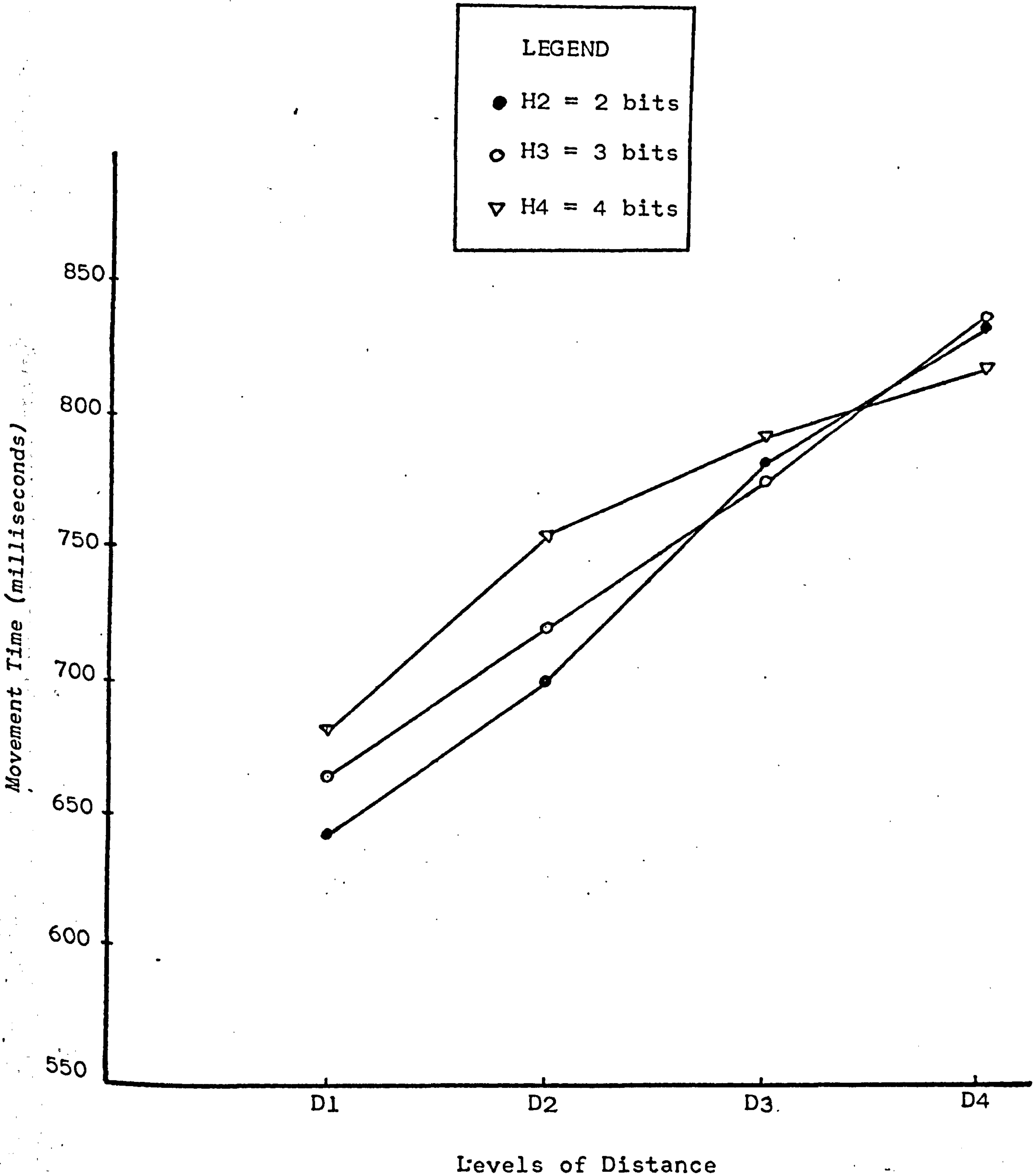


Figure (5.5). Effect of Distance on Movement Time at Different Levels of Information Load.

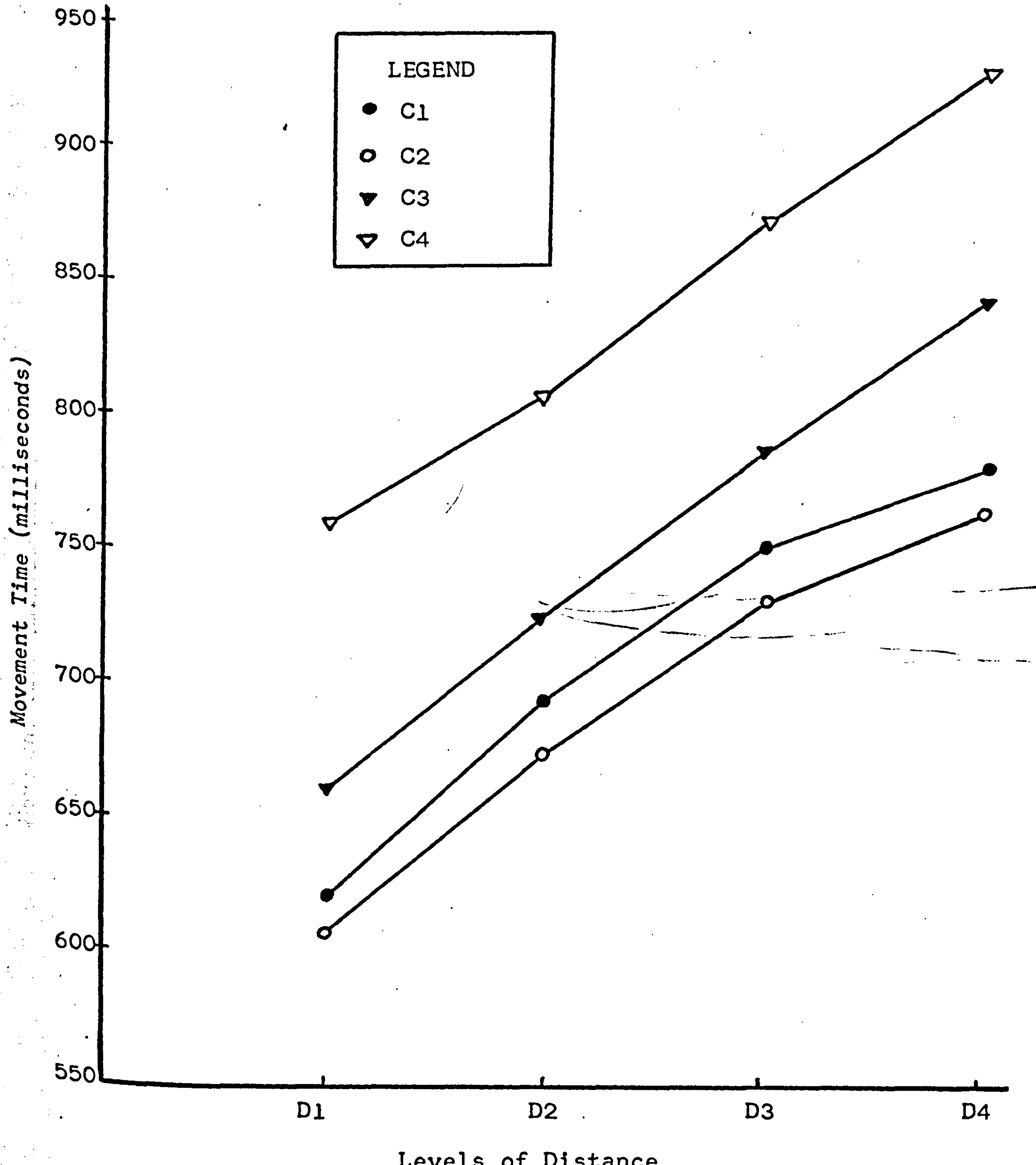


Figure (5.6). Effect of Distance on Movement Time at Different Levels of Clearance.

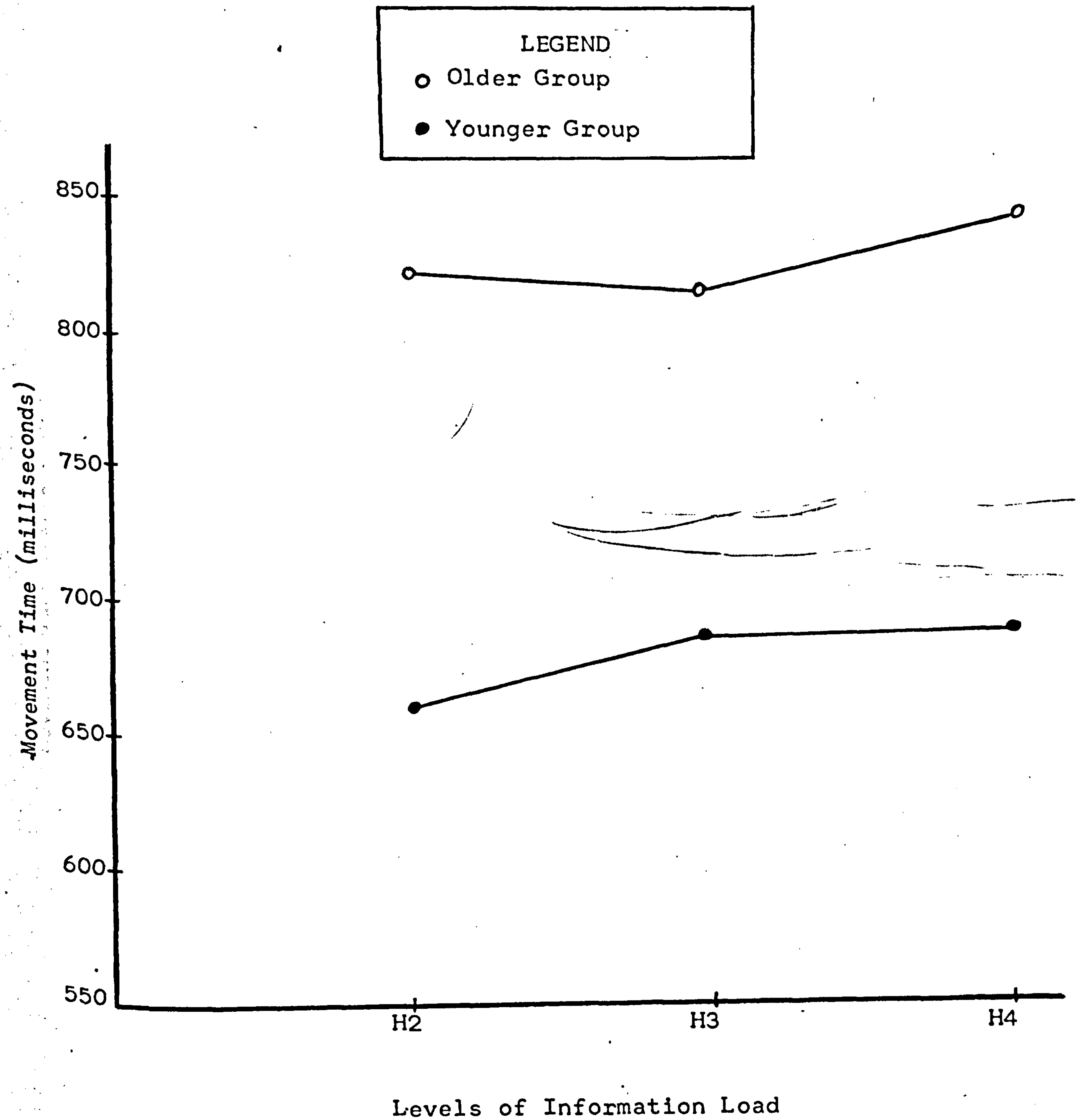


Figure (5.7). <u>Effect of Information Load on Movement Time</u>.

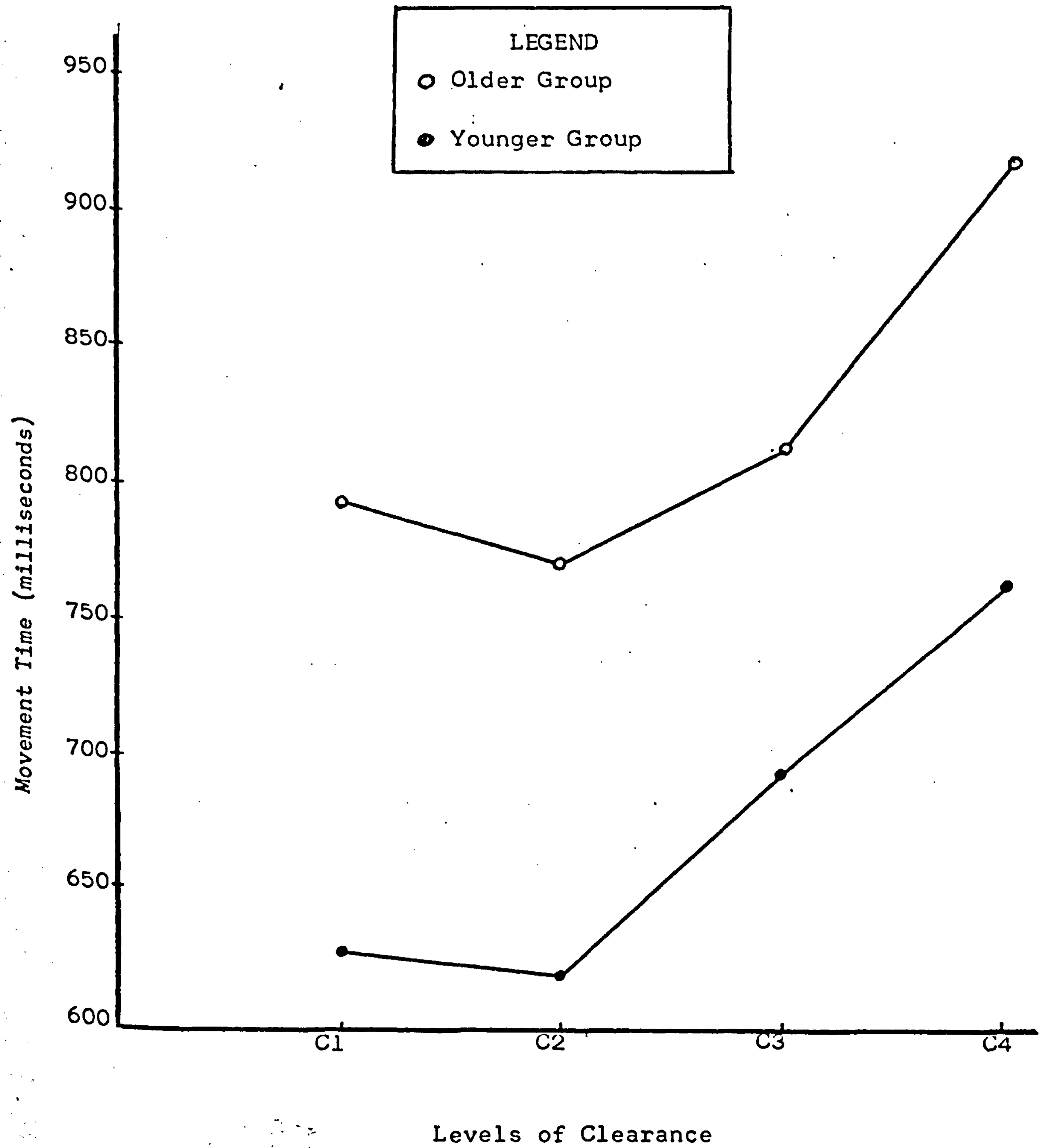


Figure (5.8). Effect of Clearance on Movement Time.

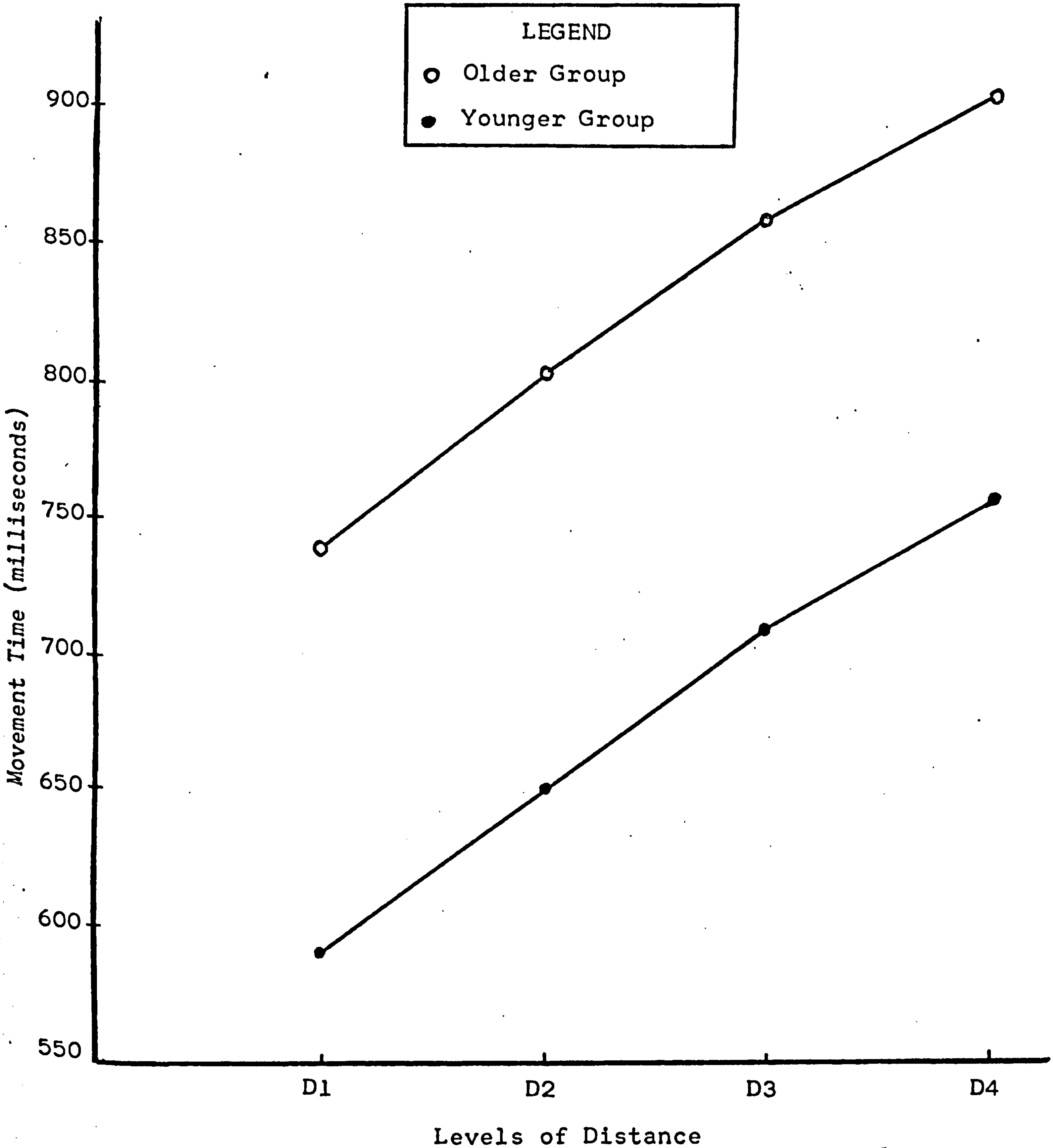


Figure (5.9). <u>Effect of Distance on Movement Time</u>.

The interactions between age and information load (GxH), between age and clearance (GxC), and between age and distance (GxD) were all not significant (Table 5.10). These also are presented graphically by plotting the means of MT at the 3 levels of H for both age groups (Figure 5.7), at the 4 levels of C for both groups (Figure 5.8), and at the 4 levels of D for both groups (Figure 5.9).

(A) Interaction between information load and distance (HxD):

The analysis of the interaction between H and D was done as follows:

Step 1: test on simple main effect of D at each level of H .

Step 2: test on difference between pairs of means of movement time for the 3 levels of H at each level of D .

Step 1

$$F = \frac{MS_{D \text{ at } Hk}}{MS_{DxS(G)}} \qquad k = 2, 3, 4 .$$

(a) test on simple main effect of D at H2:

$SS_{D \text{ at } H2} = 1723517.4$

$SS_{DxS(G)} = 440352.5$

$$F = \frac{1723517.4/3}{440352.5/54} = 70.45$$

(b) test on simple main effect of D at H3:

$SS_{D \text{ at } H3} = 1272162$

$$F = \frac{1272162/3}{8154.68} = 52.0$$

(c) test on simple main effect of D at H4:

$$SS_{D \text{ at } H4} = 885474.3$$

$$F = \frac{885474.3/3}{8154.68} = 36.19$$

Summary of the results of step 1

Effect	F	$F_{0.05,3,54}$
Main effect of D at H2	70.45*	2.87
Main effect of D at H3	52.0*	
Main effect of D at H4	36.19*	

*Difference is significant at $\alpha = 0.05$

Step 2

(a) Test on difference between pairs of means at the 3 levels of H at D1:

(i) $\overline{HD}_{31} - \overline{HD}_{21}$

where $\overline{HD}_{31}$ is the mean of MT at H3 and D1, and $\overline{HD}_{21}$ is the mean of MT at H2 and D1.

$$t = \frac{\overline{HD}_{31} - \overline{HD}_{21}}{\sqrt{2[MS_{HxS(G)} + (M-1)(MS_{DxS(G)})]/IJLM}}$$

$$= \frac{666.8 - 644.1}{\sqrt{2[9339.6 + 3 \times 8154.7]/320}} = \frac{22.7}{14.53} = 1.56$$

(ii) $\overline{HD}_{41} - \overline{HD}_{31}$

$$t = \frac{678.0 - 666.8}{14.53} = 0.78$$

(b) Test on the difference between pairs of means at the 3 levels of H at D2:

(i) $\overline{HD}_{32} - \overline{HD}_{22}$

$$t = \frac{720.0 - 699.8}{14.53} = 1.39$$

(ii) $\overline{HD}_{42} - \overline{HD}_{32}$

$$t = \frac{756.6 - 720.0}{14.53} = 2.51$$

(c) Test on the difference between pairs of means at the 3 levels of H at D3:

(i) $\overline{HD}_{23} - \overline{HD}_{33}$

$$t = \frac{783.4 - 775.9}{14.53} = 0.51$$

(ii) $\overline{HD}_{43} - \overline{HD}_{33}$

$$t = \frac{792.5 - 775.9}{14.53} = 1.13$$

(d) Test on the difference between pairs of means at the 3 levels of H at D4:

(i) $\overline{HD}_{34} - \overline{HD}_{24}$

$$t = \frac{834.0 - 836.0}{14.53} = 0.14$$

(ii) $\overline{HD}_{34} - \overline{HD}_{44}$

$$t = \frac{836.0 - 817.3}{14.53} = 1.29$$

$$t_{critical} = \frac{t_H MS_{HxS(G)} + t_D(M-1)MS_{DxS(G)}}{MS_{HxS(G)} + (M-1)MS_{DxS(G)}}$$

where t_H and t_D are the critical values for a test of level of significance $\alpha = 0.05$ for the degree of freedom corresponding to $MS_{HxS(G)}$ and $MS_{DxS(G)}$ respectively.

$t_H = 2.03$

$t_D = 2.004$

$\therefore$ $t_{critical} = 2.026$ at $\alpha = 0.05$.

Summary of the results of step 2

Difference	t	$t_{critical}$
$\overline{HD}_{31} - \overline{HD}_{21}$	1.56	2.026
$\overline{HD}_{41} - \overline{HD}_{31}$	0.78	
$\overline{HD}_{32} - \overline{HD}_{22}$	1.39	
$\overline{HD}_{42} - \overline{HD}_{32}$	2.51*	
$\overline{HD}_{23} - \overline{HD}_{33}$	0.51	
$\overline{HD}_{43} - \overline{HD}_{33}$	1.13	
$\overline{HD}_{34} - \overline{HD}_{24}$	0.14	
$\overline{HD}_{44} - \overline{HD}_{34}$	1.29	

*Difference is significant at $\alpha = 0.05$

(B) Interaction between clearance and distance (CxD):

The analysis of the interaction between C and D was done as follows:

Step 1: test on simple main effect of D at each level of C

Step 2: test on difference between pairs of means of movement time for the 4 levels of C at each level of D .

Step 1

$$F = \frac{MS_{D\ at\ CL}}{MS_{DxS(G)}}, \quad L = 1, 2, 3, 4$$

(a) Test on simple main effect of D at C1:

$SS_{D\ at\ C1} = 889988.2$

$MS_{DxS(G)} = 8154.7$

$$\therefore \quad F = \frac{889988.2/3}{8154.7} = 36.38$$

$F_{0.05,3,54} = 2.87$

(b) Test on simple main effect of D at C2:

$SS_{D\ at\ C2} = 860020.4$

$$F = \frac{860020.4/3}{8154.7} = 35.15$$

(c) Test on simple main effect of D at C3:

$SS_{D\ at\ C3} = 1077441.6$

$$F = \frac{1077441.6/3}{8154.7} = 44.04$$

(d) Test on simple main effect of D at C4:

$$SS_{D\ at\ C4} = 944982$$

$$F = \frac{944982/3}{8154.7} = 38.62$$

Summary of the results of step 1

Effect	F	$F_{0.05,3,54}$
Main effect of D at C1	36.38*	2.87
Main effect of D at C2	35.15*	
Main effect of D at C3	44.04*	
Main effect of D at C4	38.62*	

*Effect is significant at $\alpha = 0.05$

Step 2

(a) Test on difference between pairs of means of the 4 levels of C at D1.

(i) $\overline{CD}_{11} - \overline{CD}_{21}$

where $\overline{CD}_{11}$ is the mean of MT at C1 and D1, and $\overline{CD}_{21}$ is the mean of MT at C2 and D1 .

$$t = \frac{\overline{CD}_{11} - \overline{CD}_{21}}{\sqrt{2[MS_{CxS(G)} + (M-1)(MS_{DxS(g)})]/IJKM}}$$

$$= \frac{620.1 - 608.9}{\sqrt{2[19980.3 + 3 \times 8154.7]/240}}$$

$$= \frac{11.14}{19.24} = 0.579$$

(ii) $\overline{CD}_{31} - \overline{CD}_{21}$

$$t = \frac{661.1 - 608.9}{19.24} = 2.71$$

(iii) $\overline{CD}_{41} - \overline{CD}_{31}$

$$t = \frac{761.756 - 661.083}{19.24} = 5.23$$

(b) Test on difference between pairsof means at the 4 levels of C at D2:

(i) $\overline{CD}_{12} - \overline{CD}_{22}$

$$t = \frac{693.654 - 672.268}{19.24} = 1.11$$

(ii) $\overline{CD}_{32} - \overline{CD}_{22}$

$$t = \frac{726.758 - 672.268}{19.24} = 2.83$$

(iii) $\overline{CD}_{42} - \overline{CD}_{32}$

$$t = \frac{809.185 - 726.758}{19.24} = 4.28$$

(c) Test on difference between pairs of means at the 4 levels of C at D3:

(i) $\overline{CD}_{13} - \overline{CD}_{23}$

$$t = \frac{748.323 - 732.345}{19.24} = 0.83$$

(ii) $\overline{CD}_{33} - \overline{CD}_{23}$

$$t = \frac{783.813 - 732.345}{19.24} = 2.68$$

(iii) $\overline{CD}_{43} - \overline{CD}_{33}$

$$t = \frac{871.37 - 783.818}{19.24} = 4.55$$

(d) Test on difference between pairs of means at the 4 levels of C at D4:

(i) $\overline{CD}_{14} - \overline{CD}_{24}$

$$t = \frac{780.8 - 765.81}{19.24} = .78$$

(ii) $\overline{CD}_{34} - \overline{CD}_{24}$

$$t = \frac{841.7 - 765.8}{19.24} = 3.94$$

(iii) $\overline{CD}_{44} - \overline{CD}_{34}$

$$t = \frac{928.2 - 841.7}{19.24} = 4.49$$

Summary of the results of step 2

Difference	t	$t_{critical}$
$\overline{CD}_{11} - \overline{CD}_{21}$	0.579	2.004
$\overline{CD}_{31} - \overline{CD}_{21}$	2.71*	
$\overline{CD}_{41} - \overline{CD}_{31}$	5.23*	
$\overline{CD}_{12} - \overline{CD}_{22}$	1.11	
$\overline{CD}_{32} - \overline{CD}_{22}$	2.83*	
$\overline{CD}_{42} - \overline{CD}_{32}$	4.28*	
$\overline{CD}_{13} - \overline{CD}_{23}$	0.83	
$\overline{CD}_{33} - \overline{CD}_{23}$	2.68*	
$\overline{CD}_{43} - \overline{CD}_{33}$	4.55*	
$\overline{CD}_{14} - \overline{CD}_{24}$	.78	
$\overline{CD}_{34} - \overline{CD}_{24}$	3.94*	
$\overline{CD}_{44} - \overline{CD}_{34}$	4.49*	

*Difference is significant at $\alpha = 0.05$

5.2.2 Second Model

The second model of the movement time (Equation 4.4) is a mixed model with only the subjects as a random factor and all the other factors (age, information load and index of difficulty) fixed. Since the experimental factors in this model are the same as in the second model of the decision time (Section 5.1.2), there was no need to calculate the E(MS) values again and table 5.8 was used as an indicator of the appropriate F-ratios.

The analysis of variance was done and the results of the analysis are summarized in Table 5.17.

Table 5.17 ANOVA for Movement Time (Second model)

Source	d.f.	MS	F	$F_{critical}$
Between Subjects				
G	1	5192493.9	12.74*	4.41
S(G)	18	407639.5		
Within Subjects				
H	2	34717.5	3.72*	3.27
GxH	2	22912.0	2.45	3.27
HxS(G)	36	9339.6		
ID	15	462545.7	68.61*	1.8
GxID	15	5467.3	0.81	1.8
IDxS(G)	270	6741.6		
HxID	30	6974.9	2.22*	1.46
GxHxID	30	3092.6	0.99	1.46
HxIDxS(G)	540	3138.1		

*Significant at $\alpha = 0.05$

Analysis of the main effect of index of difficulty (ID)

The analysis of the main effect of ID was done by testing the differencesbetween all possible pairs of means of MT at the 16 levels of ID. Table (5.18) summarizes the means of MT at the different levels of ID.

The standard error of the mean for all observations at a given level of ID is:

$$S_{ID} = \sqrt{\frac{MS_{IDxS(G)}}{IJK}} = \sqrt{\frac{50562.25}{60}} = 29.03$$

The results of the test are summarized in table 5.19. From table 5.19 (see also Figure 5.10) it was found that there are inconsistences between the ascending order of the ID (see Table 4.1) and the means of the MT at the 16 levels of ID [e.g. the mean of MT at the 4th level of ID (ID = 5.415) was significantly greater than the mean of MT at the 5th level of ID (ID = 5.807)]. This inconsistency was greater between the first 8 levels of ID, but diminished at the higher levels (no significant difference between 8th and 9th levels nor between 12th and 13th levels). These are discussed further in the next chapter.

Table 5.18 Means of Movement Time at the Different Levels of ID

Levels of ID	ID	Mean of MT (Younger group)	Mean of MT (Older group)	Mean of MT (All subjects)
1	4.222	543.6	696.6	620.1
2	4.737	606.8	780.5	693.7
3	5.115	664.7	832.0	748.3
4	5.415	702.0	859.6	780.8
5	5.807	540.3	677.5	608.9
6	6.322	598.2	749.3	672.3
7	6.700	652.8	811.9	732.3
8	7.000	690.6	841.0	765.8
9	7.796	599.8	722.4	661.1
10	8.310	666.7	786.8	726.8
11	8.689	730.9	836.7	783.8
12	8.989	778.3	905.1	841.7
13	10.773	683.6	839.9	761.8
14	11.288	729.1	889.3	809.2
15	11.666	790.6	952.2	871.4
16	11.966	851.3	1005.1	928.2

Table 5.19 Test on Means of MT at the 16 Levels of ID

	I_5	I_1	I_9	I_6	I_2	I_{10}	I_7	I_3	I_{13}	I_8	I_4	I_{11}	I_{14}	I_{12}	I_{15}	I_{16}	$S_{ID} \times q_{.95}(r,36)$
I_5		11.2	52.2	63.4	84.8	117.9	123.4	139.4	152.8*	156.9*	171.9*	174.9*	200*	232.8*	262*	319*	150.9
I_1			41	52	73	106	112	128	142	146	161*	164*	189*	222*	251*	307*	149.5
I_9				11	32	66	71	87	101	105	119	123	148*	181*	210*	266*	147.0
I_6					21	54	60	76	90	94	108	112	136	169*	199*	256*	146
I_2						33	39	55	68	72	87	90	115	148*	177*	234*	144
I_{10}							6	21	35	39	54	57	82	114	145*	201*	141.7
I_7								16	29	33	49	51	76	109	139*	196*	138.4
I_3									13	17	32	35	61	93	123	180*	135.9
I_{13}										4	19	22	47	80	109	166*	132.4
I_8											15	18	43	76	106	162*	128.3
I_4												3	28	61	91	147*	124
I_{11}													25	58	88	144*	118.4
I_{14}														32	62	119*	110.9
I_{12}															30	87	100.7
I_{15}																57	83.6

*Difference is significant at $\alpha = 0.05$

Regression Models

Two regression models were developed for both groups (younger group and older group) using Fitts' model (Equation 2.1):

$$MT = a + b\ ID$$

where MT = movement time in milliseconds

ID = Index of difficulty in bits.

considering the inconsistency mentioned before, only the last 12 levels of ID (Table 4.1) were used in developing the regression models. The results were as follows:

Younger group

For the younger group the model is,

$$MT = 399.2 + 33.44\ ID$$

with correlation coefficient $r = 0.82$.

Older group

For the older group the model is,

$$MT = 516.5 + 36.4\ ID$$

with correlation coefficient $r = 0.83$.

The computer program and the results of the regression analysis are listed in Appendix D. Figure 5.11 presents the regression lines for both groups.

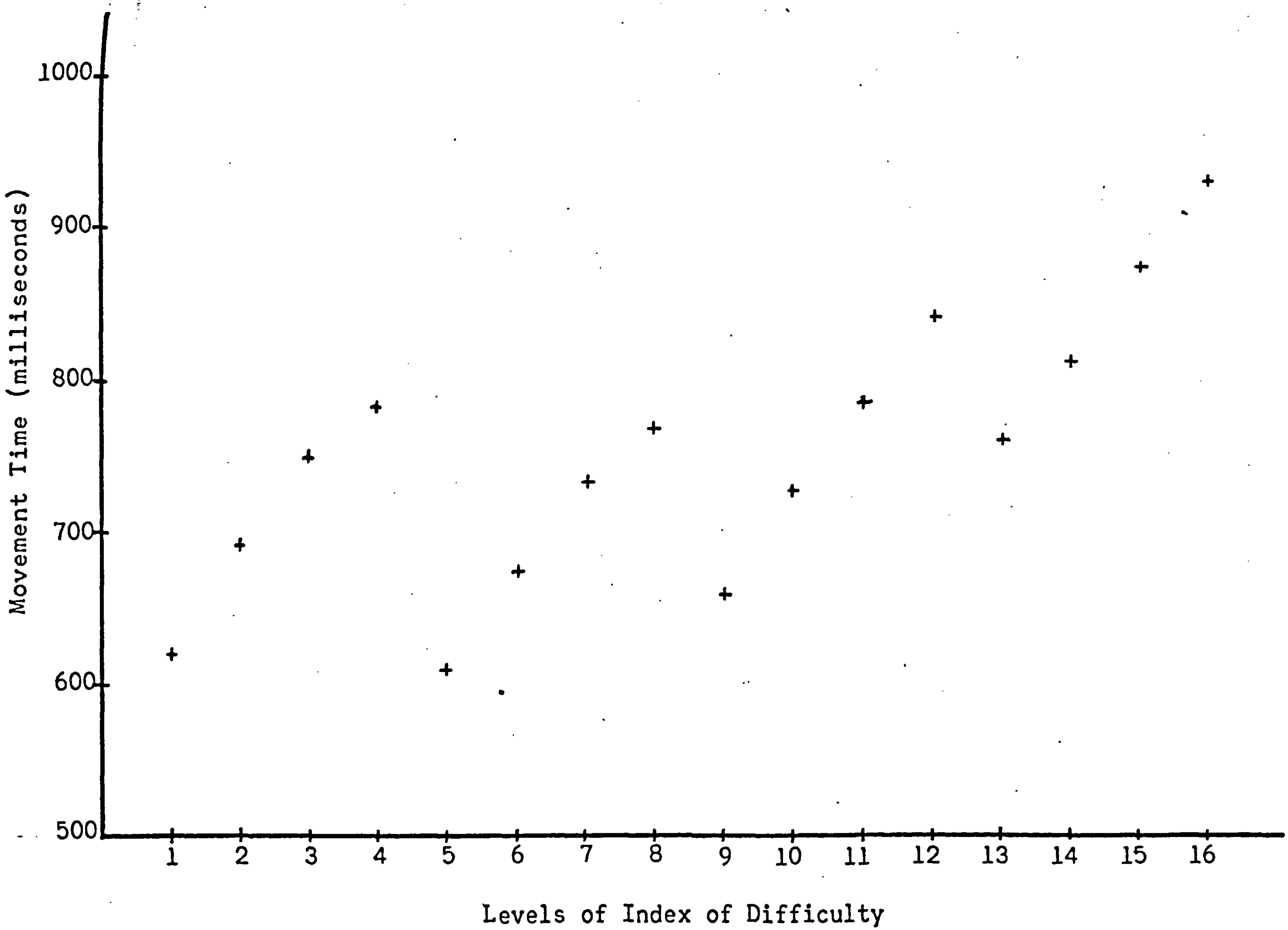


Figure (5.10). Effect of Index of Difficulty on Movement Time (all subjects).

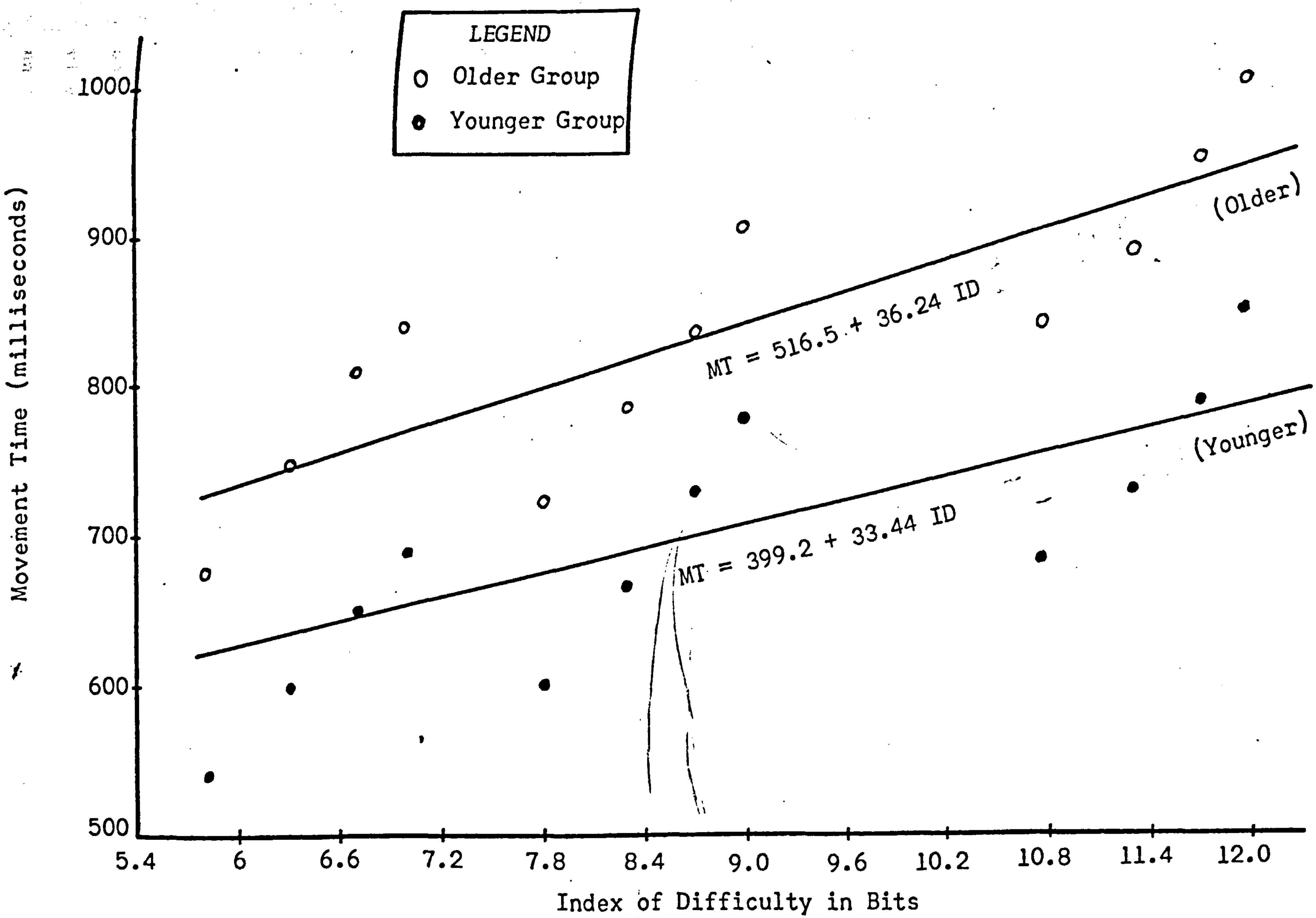


Figure (5.11). Effect of Index of Difficulty on Movement Time for Both Groups.

5.2.a Performance Time

The performance time i.e. sum of the decision and movement times was recorded. The means of 40 observations per cell were recorded and subjected to an analysis of variance using a similar mathematical model as for the first model for decision and movement times. Since the use of ID as an independent variable did not add to the findings of the study, only one model was used for the analysis of variance of performance time. The results are summarized in Table 5.19a.

An examination of Table 5.19a reveals the significance of age, clearance, information load and distance of move on performance time ($p \leq 0.05$). A comparison of Table 5.19a with Tables 5.2 and 5.10 for decision time and movement time analysis reveals that the significance of age, information load and distance on performance time is also applicable to the decision and movement times. However, the significance of clearance on performance time is principally due to its significance on the movement time component rather than the decision time. This is primarily because the amount of clearance directly affected the extent of positioning of the pin involved before it could be dropped into the hole. There is evidence to suggest that positioning tasks involve a high degree of learning (Tsui, 1977). However, since all subjects had had a sufficient amount of practice on the task, it can be inferred that some slowing of the sensorimotor function with age is suggested.

The significance of age (G) x information load (H) interaction in its effects on performance time (Table 5.19a) is primarily due to its effects on decision time rather than movement time. It can be concluded that, for older people, the effects of an increase in task complexity as measured by an increase in information, are to lengthen the decision-making time.

Table 5.19.a ANOVA for Performance Time Model

Source	d.f.	MS	F	F critical
Between Subjects				
G	1	41775612	40.7 *	4.41
S(G)	18	1026114		
Within Subjects				
H	2	5748378	99.65 *	3.27
GxH	2	244410	4.24 *	3.27
HxS(G)	36	57683		
C	3	1434223	50.45 *	2.78
GxC	3	7835	0.28	2.78
CxS(G)	54	28426		
D	3	1186737	113.23 *	2.78
GxD	3	5506	0.53	2.78
DxS(G)	54	10480		
HxC	6	18556	0.73	2.18
GxHxC	6	42469	1.67	2.18
HxCxS(G)	108	25439		
HxD	6	54396	13.35 *	2.18
GxHxD	6	5656	1.39	2.18
HxDxS(G)	108	4074		
CxD	9	3210	1.2	1.94
GxCxD	9	1456	0.54	1.94
CxDxS(G)	162	2679		
HxCxD	18	2261	1.2	1.61
GxHxCxD	18	1467	0.78	1.61
HxCxDxS(G)	324	1880		

* Effect is significant at $\alpha = 0.05$

5.3 Performance Errors

The percentage of performance errors in each experimental run was computed as follows (see Appendix C):

$$\% \text{ of performance errors} = \frac{\text{number of errors}}{\text{number of cycles per run}} \times 100 \,.$$

In order to apply the analysis of variance the following transformation was used on the % of errors data

$$\phi(X) = \sin^{-1}(\sqrt{X})$$

where X is the % of performance errors.

The transformed data were then subjected to an analysis of variance using the performance errors model (Equation 4.5) discussed before. The E(MS) values were calculated (Table 5.20) as an indicator of the appropriate F-ratios.

The analysis of variance was done using the SAS package (ANOVA PROCEDURE). The results of the analysis of variance are summarized in Table 5.21.

Table 5.20 E(MS) for the Percentage of Errors Model

Effect	F I 2	R J 10	F K 3	F L 4	F N 1	E(MS)
Between Subjects						
G	0	10	3	4	1	$\sigma_R^2 + 12\sigma_S^2 + 120\sigma_G^2$
S(G)	1	1	3	4	1	$\sigma_R^2 + 12\sigma_S^2$
Within Subjects						
H	2	10	0	4	1	$\sigma_R^2 + 4\sigma_{HS}^2 + 80\sigma_H^2$
GxH	0	10	0	4	1	$\sigma_R^2 + 4\sigma_{HS}^2 + 40\sigma_{GH}^2$
HxS(G)	1	1	0	4	1	$\sigma_R^2 + 4\sigma_{HS}^2$
C	2	10	3	0	1	$\sigma_R^2 + 3\sigma_{CS}^2 + 60\sigma_C^2$
GxC	0	10	3	0	1	$\sigma_R^2 + 3\sigma_{CS}^2 + 30\sigma_{GC}^2$
CxS(G)	1	1	3	0	1	$\sigma_R^2 + 3\sigma_{CS}^2$
HxC	2	10	0	0	1	$\sigma_R^2 + \sigma_{HCS}^2 + 20\sigma_{HC}^2$
GxHxC	0	10	0	0	1	$\sigma_R^2 + \sigma_{HCS}^2 + 10\sigma_{GHC}^2$
HxCxS(G)	1	1	0	0	1	$\sigma_R^2 + \sigma_{HCS}^2$
R	1	1	1	1	1	σ_R^2

Table 5.21 ANOVA for the Percentage of Errors

Source	d.f.	MS ($\times 10^4$)	F	$F_{critical}$
Between Subjects				
G	1	11.6	0.71	4.41
S(G)	18	16.5		
Within Subjects				
H	2	414.0	25.7*	3.27
GxH	2	4.5	0.24	3.27
HxS(G)	36	18.0		
C	3	11.7	1.1	2.78
GxC	3	11.2	1.06	2.78
CxS(G)	54	11.0		
HxC	6	6.3	0.39	2.18
GxHxC	6	5.9	0.36	2.18
HxCxS(G)	108	16.2		

*Effect is significant at $\alpha = 0.05$

5.3.1 Test on Homogeneity of Interactions with Subjects

Test on homogeneity of interactions with subjects was done using Bartlett's test. Results are presented in Appendix E. Since the observed Chi square (1.8) is less than the critical value (3.22) for a test with $\alpha = 0.20$, the test indicates that the interactions could be pooled. Equivalently, the test indicates that interactions with subjects could be dropped from the model. Therefore the new model for the percentage of errors will be:

$$
\begin{aligned}
X_{ijkl} = {} & \mu + \alpha_i + \beta_{j(i)} + \gamma_k + \delta_l \\
& + \alpha\gamma_{ik} + \alpha\delta_{il} + \gamma\delta_{kl} \\
& + \alpha\gamma\delta_{ikl} + \varepsilon_{(ijkl)} \qquad (5.1)
\end{aligned}
$$

where μ , α , β , γ , δ and X are as defined before and $\varepsilon_{(ijkl)}$ is the residuals containing the interactions with subjects pooled together.

The analysis of variance was done again using Model 5.1. The results of the analysis are summarized in Table 5.22.

Table 5.22 ANOVA for Percentage of Errors Model with Pooled Interactions with Subjects

Source	d.f	MS ($\times 10^4$)	F	$F_{critical}$
Between Subjects				
G	1	11.6	0.71	3.89
S(G)	18	16.5		
Within Subjects				
H	2	474.0	31.6*	3.04
GxH	2	4.5	0.3	3.04
C	3	11.7	0.78	2.65
GxC	3	11.2	0.75	2.65
HxC	6	6.3	0.42	2.14
GxHxC	6	5.9	0.39	2.14
Error	198	15.0		

*Effect is significant at $\alpha = 0.05$

5.3.2 Analysis of the Main Effects

From the ANOVA Table 5.22, it is found that the main effect of the information load was the only significant effect. All the other main effects and interactions were not significant. The mean percentage of the performance errors at each level of H are presented in Table 5.23. Figure 5.12 shows the effect of information load on percentage of errors for both groups.

Table 5.23

Mean percentage of performance errors at the 3 levels of H.

levels of H	Mean percentage of errors
H2	0.0135
H3	0.021
H4	0.059

The analysis of the main effect of H was done using Newman-Kuel's method as follows:

The standard error of the mean for all observations at a given level of factor H is:

$$S_{\bar{H}} = \sqrt{\frac{MS_{error}}{IJL}}$$

$I = 2 \qquad J = 10 \qquad L = 4$

$$\therefore \quad S_{\bar{H}} = \sqrt{\frac{0.0015}{80}} = 0.0043$$

	H2	H3	H4	r	$S_{\bar{H}} \times q_{.95,r,198}$
H2		0.0075	0.045*	3	0.014
H3			0.038*	2	0.0117

*Difference is significant at $\alpha = 0.05$

From the above table it is found that the difference between means at H2 and H4 and between H3 and H4 were significant, but between H2 and H3 was not significant.

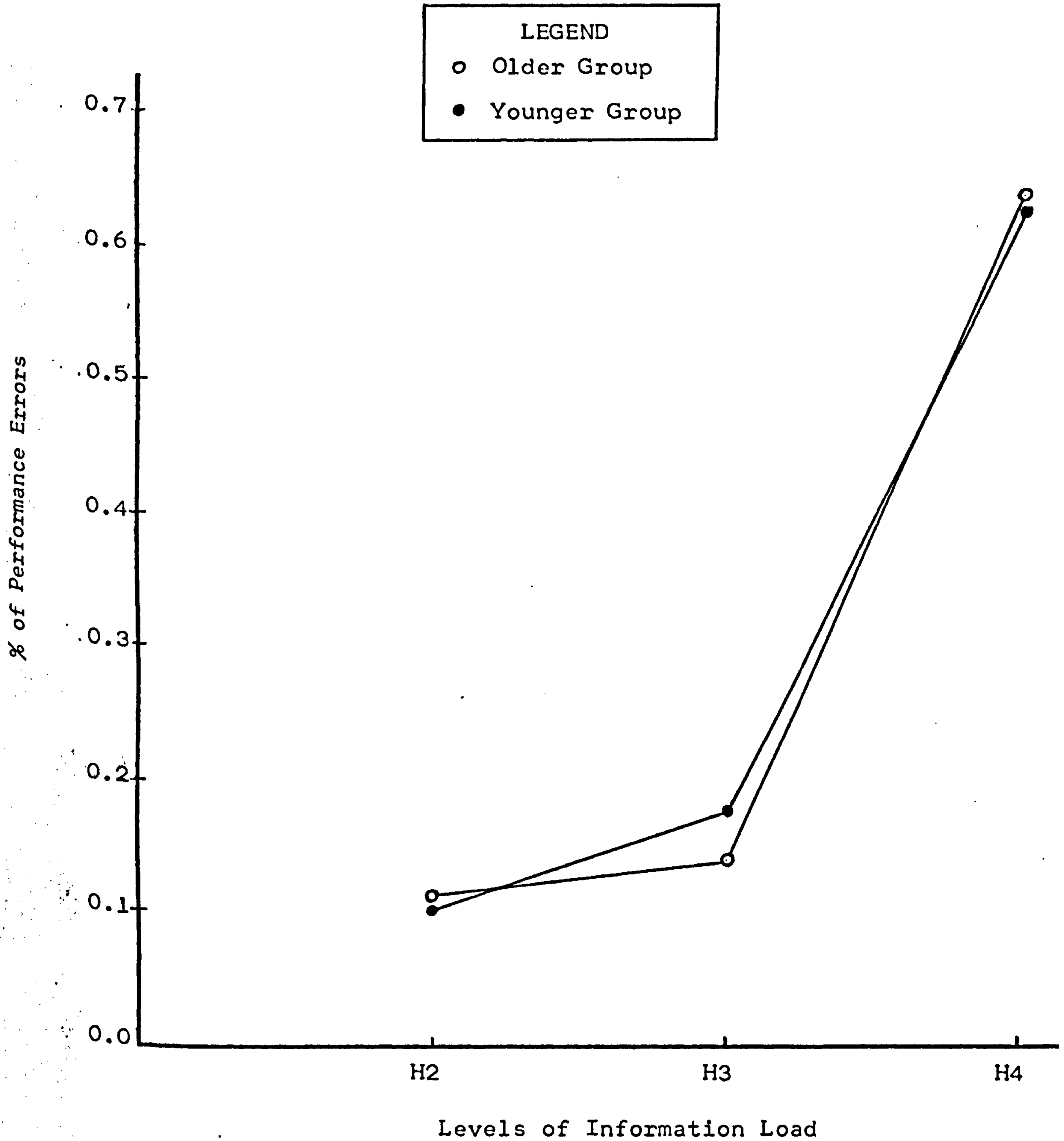


Figure (5.12). Effect of Information Load on Performance Errors.

5.4 Heart Rate

Subjects heart rate was recorded, using Grass Recording System, for the six experimental runs assigned before (1, 2, 3, 10, 11, and 12). The number of heart beats/minute was recorded for a 10 minute interval for each run that lasted about 13 minutes. The average of the heart rate was calculated for each run over the 10 minutes. The percentage increase in heart rate was calculated as follows:

$$R_{ijkq} = \frac{\overline{HR}_{ijkq} - \overline{HR}_{ij\text{ at rest}}}{\overline{HR}_{ij\text{ at rest}}} \times 100$$

where

$\overline{HR}_{ijkq}$ = average heart rate for the qth level of clearance, kth level of information load, jth subject and ith age group.

$\overline{HR}_{ij\text{ at rest}}$ = average heart rate, at rest, for the jth subject in the ith group.

$i = 1, 2 \quad j = 1, \ldots, 10 \quad k = 1, 2, 3 \quad q = 1, 4$

and

R_{ijkq} = % heart rate increase at the qth level of clearance, kth level of information load, jth subject and ith age group.

In order to apply the analysis of variance the following transformation was used on the % increase in heart rate

$$\phi(R) = \sin^{-1}(\sqrt{R})$$

where R is the % increase in heart rate.

The transformed data were subjected to analysis of variance using the heart rate model (Equation 4.6) discussed before. The E(MS) values were calculated (Table 5.24) as an indicator of the appropriate F-ratios. The test on the main effect of the experimental factors (G, C and H) and the interactions between them (GxC, GxH, CxH and GxCxH) was done using the interaction with the subjects within the groups as an error terms.

The analysis of variance was done using the SAS package (ANOVA PROCEDURE). The results of the analysis of variance are summarized in Table 5.25.

Table 5.24 E(MS) for the Heart Rate Model

Effect	F I 2	R J 10	F K 3	F q 2	F N 1	E(MS)
Between Subjects						
G	0	10	3	2	1	$\sigma_R^2 + 6\sigma_S^2 + 60\sigma_G^2$
S(G)	1	1	3	2	1	$\sigma_R^2 + 6\sigma_S^2$
Within Subjects						
H	2	10	0	2	1	$\sigma_R^2 + 2\sigma_{HS}^2 + 40\sigma_H^2$
GxH	0	10	0	2	1	$\sigma_R^2 + 2\sigma_{HS}^2 + 20\sigma_{GH}^2$
HxS(G)	1	1	0	2	1	$\sigma_R^2 + 2\sigma_{HS}^2$
C	2	10	3	0	1	$\sigma_R^2 + 3\sigma_{CS}^2 + 60\sigma_C^2$
GxC	0	10	3	0	1	$\sigma_R^2 + 3\sigma_{CS}^2 + 30\sigma_{GC}^2$
CxS(G)	1	1	3	0	1	$\sigma_R^2 + 3\sigma_{CS}^2$
HxC	2	10	0	0	1	$\sigma_R^2 + \sigma_{HCS}^2 + 20\sigma_{HC}^2$
GxHxC	0	10	0	0	1	$\sigma_R^2 + \sigma_{HCS}^2 + 10\sigma_{GHC}^2$
HxCxS(G)	1	1	0	0	1	$\sigma_R^2 + \sigma_{HCS}^2$
R	1	1	1	1	1	σ_R^2

Table 5.25 ANOVA for Percentage Increase in Heart Rate

Source	d.f.	MS $(x10^3)$	F	$F_{critical}$
Between Subjects				
G	1	31.2	1.26	3.89
S(G)	18	24.8		
Within Subjects				
H	2	12.7	2.22	3.27
GxH	2	2.3	0.41	3.27
HxS(G)	36	5.7		
C	1	52.8	8.02*	3.89
GxC	1	0.23	0.04	3.89
CxS(G)	18	6.6		
HxC	6	0.4	0.13	2.38
GxHxC	6	1.3	0.38	2.38
HxCxS(G)	36	3.3		

*Significant at $\alpha = 0.05$

5.4.1 Test on Homogeneity of Interactions with Subjects using Bartlett's Test

Test on the homogeneity of interactions with subjects was done using Bartlett's test. Results are presented in Appendix E. Since the observed Chi square exceeds the critical value for a test with $\alpha = .20$, the test indicates that the interactions should not be pooled.

Table 5.22 shows that the only significant effect was the main effect of the clearance. All the other main effects and the interactions were not significant. The means of the percentage increase in heart rate for both groups under each level of H, also under each level of C are summarized in Table 5.26 and 5.27 and illustrated graphically in Figures 5.13 and 5.14.

Table 5.26 Means of % increase in heart rate for both groups at the 3 levels of H

Levels of H	Younger group G1	Older group G2
H2=2 bits	2.43	3.38
H3=3 bits	3.20	4.06
H4=4 bits	2.76	4.58

Table 5.27 Means of % increase in heart rate for both groups at the 2 levels of C

Levels of C	Younger group G1	Older group G2
C1 = 0.75"	2.22	3.26
C4 = 0.008"	3.38	4.75

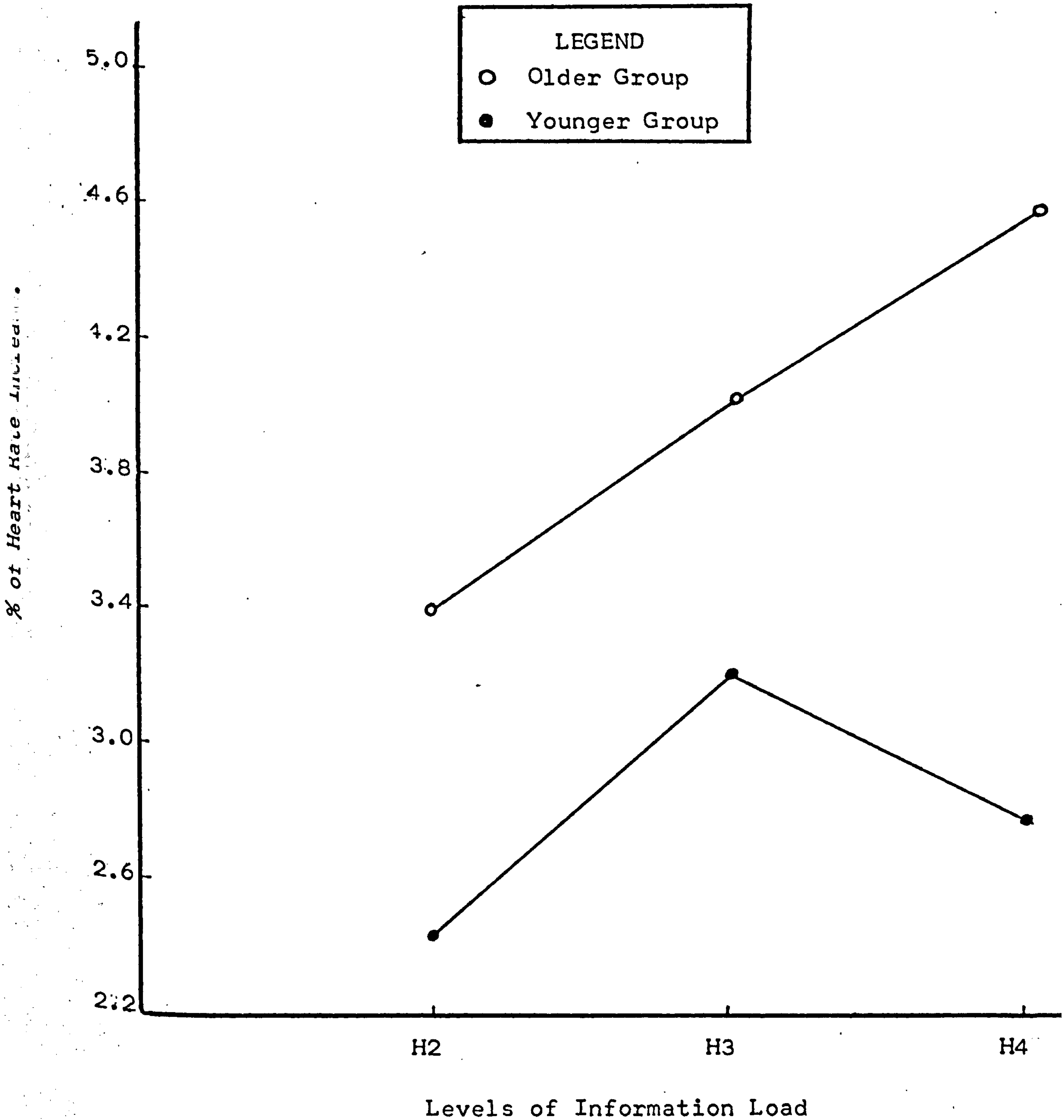


Figure (5.13). Effect of Information Load on Heart Rate.

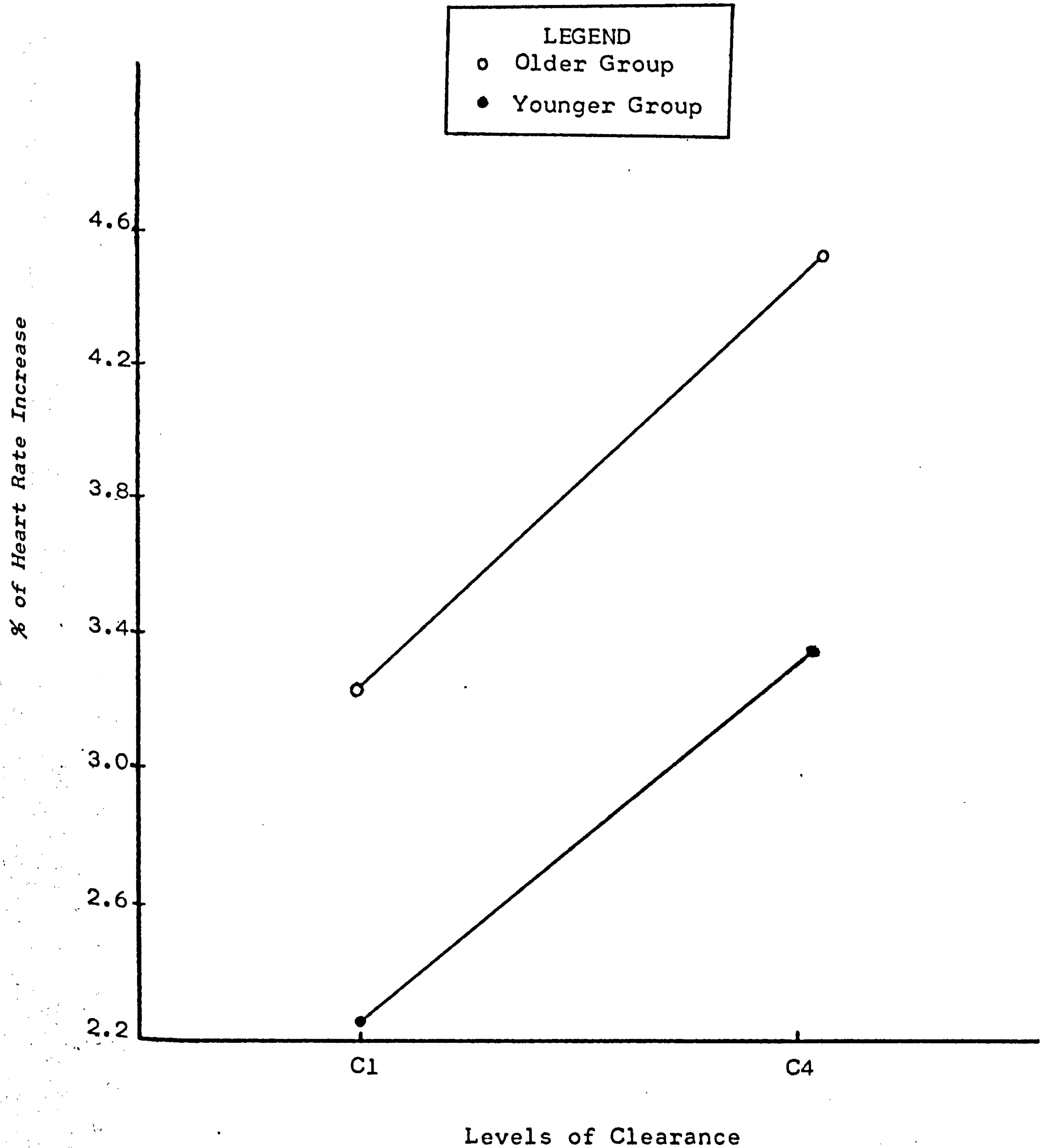


Figure (5.14). Effect of Clearance on Heart Rate.

CHAPTER VI

RESULTS AND DISCUSSION

This chapter summarizes the results of the findings of the present study and examines their implications. Data analysis for decision time, movement time, performance errors and heart rate are summarized in the following sections:

6.1 Decision Time

The results of the analysis of the decision time data could be summarized as follows for the two models.

6.1.1 First Model

a) Decision time was significantly longer for the older group than for the younger group ($p < 0.05$). Older subjects took 63% longer in making decisions than did the younger subjects on the average. Those results support the general finding that older people take more time in the process of extracting information from signals, due to a gradual impairment of perceptual processes. This finding is well documented in the literature (e.g. Spirduso, 1975; Tolin and Simon, 1968).

b) Information load (H) had a significant effect on decision time. The interaction between age and information load (GxH) was also found to be significant. Analysis of the main effect of information load and the interaction between age and information load has shown that, for both groups, decision time increased significantly when the information load was increased from 2 bits to 3 bits and from 3 bits to 4 bits. Older subjects were also significantly slower in making the decisions, at each level of information load, than were the younger subjects. While both younger and older subjects took significantly longer time to make difficult choices (at higher levels of information load) than they took to make simpler ones, the increased time needed to make difficult choices was proportionally greater in the case of older subjects. Since the decision time is regarded as an indicator of the time taken by central processes and it mainly consists of the time taken from perception to action and the shaping and initiation of the responding movement (Welford, 1959), the proportionally greater time needed by the older subjects at the higher levels of information load was not only due to the deterioration of the perceptual processes but also due to a marked reduction in information processing abilities as a function of the ageing process.

c) Clearance between the pin and the hole did not affect the decision time significantly. The interaction between age and clearance was also not significant. Figure 5.2 shows that the older subjects were slower than the younger subjects in making decisions at the 4 levels of clearance by a constant amount (about 270 milliseconds on average). Also, no significant interaction was found between clearance and information load or between clearance and distance. From this finding, it appears that clearance is not one of the significant determinants of decision time.

d) The distance of movement significantly affected the decision time ($p < 0.05$). However, the interaction between age and distance was not significant. For both groups, decision time was significantly lower for the smallest distance (D1 = 7") than for the other 3 distances (D2 = 10", D3 = 13" and D4 = 16"). Decision time was also lower for the largest distance (D4 = 16") than for the 10" and 13" distances, but not significantly. Analysis of the significant interaction between distance and information load (DxH; $p < 0.05$) has shown that this significant effect of the distance on decision time was only at the higher level of information load (H = 4 bits). In other words, when the information load increases so that the subject has to decide between many alternatives (16 alternatives when H = 4 bits), the extreme positional locations of some of these alternatives in the task layout results in a lower decision time than the positions of the other alternatives. In this experiment the extreme positions were for holes numbered 1, 2, 3 and 4 (top row) and holes numbered 13, 14, 15 and 0 (bottom row) (see Figure 3.2). In light of this observation it could be said that decision time could be affected not only by the number of alternatives, but also by their arrangement.

6.1.2 Second Model

The results of the analysis of the second decision time model (by combining the clearance and the distance in an index of difficulty using Fitts' formula, Equation 2.1) were consistent with the results of the first model, and therefore did not add any new findings. The main effect of index of difficulty was not significant, nor was the interaction between age and index of difficulty.

In light of the previous findings the following could be stated:

a) By increasing the information load in a task, the increase in time needed for making decisions is proportionally greater for older workers than for younger ones. In general, however, decision time could be affected by the arrangement of the task itself.

b) Increasing the task difficulty has no effect on the difference in decision time between the older and the younger (see Figures 5.2 and 5.3).

6.2 Movement time

The results of the analysis of the movement time data could be summarized for the two models as follows:

6.2.1 First Model

a) Older subjects took significantly longer movement times than younger subjects ($p < 0.05$). Movement time was 22% longer for the older group than for the younger group on the average. Since the movement involved guiding the hand and positioning the pin on a small target (hole), it could be inferred that both the guiding and positioning processes that require control mediation are adversely affected by age. This finding is also supported by Spirduso, 1975; Singleton, 1954; and Szafran, 1951.

b) Clearance between the pin and the hole had a significant effect on movement time ($p < 0.05$), the movement time was found to be higher for the smaller clearance. Analysis of the main effect of the clearance showed no significant difference in movement time at the higher levels of clearance (C1 = 0.75" and C2 = 0.25"), but the movement time increased sharply and significantly for both groups for the smaller clearances (C3 = 0.063" and C4 = 0.008"). Moving the hand toward a target involves a number of corrections to the direction of the movement by the central process guiding the hand (Fitts, 1954). It appears that the smaller the hole size, the more corrections are needed to direct the movement in order to position the pin into the hole thereby increasing the movement time. The analysis of variance also showed no significant interaction between age and clearance. This is supported by Welford (1959), who concluded that slowing among older people cannot be conceived as being a lowering of the rate of information transfer and is not proportional over various amplitudes and target sizes.

c) Distance moved significantly affected the movement time ($p < 0.05$). However, the interaction between age and distance was not significant. These findings also support the findings of Welford (1959). Analysis of the main effect of distance on movement time has shown that movement times are significantly different at each level of distance (D1 = 7", D2 = 10", D3 = 13" and D4 = 16"). Analysis of the significant interactions between distance and clearance and between distance and information load has shown that the simple main effect of distance was significant at each level of clearance and at each level of information load. The interaction between the distance and the clearance was expected, since both are the factors affecting task difficulty.

d) Information load had a significant effect on movement time ($p < 0.05$), but no interaction was found between age and information load. Analysis of the main effect of information load showed that movement time is significantly affected only when the information load increased to 4 bits (16 alternatives). No significant difference was found between means of movement times at the lower level of information load (H2 = 2 bits and H3 = 3 bits). It seems, therefore, that increasing the number of the task alternatives has an effect on the central processes and causes a slowing of the control of movement.

6.2.2 Second Model

Analysis of variance for the second movement time model (by combining the clearance and the distance in an index of difficulty) has shown a significant effect of index of difficulty (ID) on the movement time ($p < 0.05$).

No significant interaction between age and index of difficulty was found. The results of the analysis of the second model were consistent with the results of the first model.

The analysis of the main effect of the index of difficulty was done by a test on difference between all possible means of movement time at each level of index of difficulty (16 levels). The result of this test showed an inconsistency between the means of movement times for the 16 levels of index of difficulty (see Tables 5.18 and 5.19). The mean of movement time (780 milliseconds) at the 4th level of ID (ID = 5.415 bits by combining C1 = 0.75" and D4 = 16") was significantly greater than the mean of movement time (608 milliseconds) at the 5th level of ID (ID = 5.807 bits by combining C2 = 0.25" and D1 = 7"). Since the analysis of the main effect of the clearance showed no significant difference between mean of movement time at C1 and C2; it could be said that the inconsistency mentioned before was due to the effect of the distance (distance was 16" for the 4th level of ID and 7" for the 5th level). This inconsistency in the results is diminished at the higher levels of ID. This is an indicator that the use of Fitts' formula ($ID = \log_2 \frac{2A}{W}$) to represent task difficulty is not an accurate indicator when the ratio $\frac{2A}{W}$ decreases beyond certain limits (about 50).

The results of the regression models using Fitts' model (Equation 2.2) for both groups, have shown that movement time could be predicted for each group as follows:

For younger group

$$MT = 399.2 + 33.44\ ID$$

For older group

$$MT = 516.5 + 36.24\ ID$$

where MT is movement time in milliseconds and ID is the index of difficulty in bits.

From the above models it could be noticed that the difference between the two models is mainly in the intercept part. The slope of the two lines is not significantly different (see Figure 5.11). This finding indicates that the slowing among older people is not proportional over various degrees of task difficulty. This is consistent with the results of the first model and with the findings of Welford (1959) mentioned before.

6.3 Performance Errors

The results of the analysis of the performance errors could be summarized as follows:

a) No significant difference was found between older subjects and younger subjects in the percentage of performance errors. Neither the main effect of age nor the interaction between age and clearance and between age and information load had a significant effect on the percentage of errors. Since the percentage of the performance errors in this task was very small (about 0.3% on the average), the previous results of the analysis could not be taken as sufficient evidence that the accuracy of performance for the older and the younger worker is the same in general. On the other hand, this could be taken as evidence that the slowness of the older subjects in such task was not because they restored accuracy at the expense of speed.

b) Information load had a significant effect on the increase of the performance errors ($p < 0.05$). Analysis of the main effect of the information load on the percentage of errors has shown that for both groups the percentage of errors increased significantly when the information load increased from 3 bits to 4 bits. No significant difference was found between the percentage of errors for the 2 bits and 3 bits of information load. These findings indicate that by increasing information load one can increase speed only at the expense of accuracy. These are due to the limitation of the central processor and the person's sensors or effectors. (Shannon and Weaver, 1949).

c) No significant effect was found for the clearance between the pin and the hole on the percentage of performance errors. This finding was expected since the only type of errors in this task (positioning the pin in the wrong hole) seems independent on the clearance between the pin and the hole.

6.4 Heart Rate

The results of the analysis of the heart rate data could be summarized as follows:

a) No significant difference was found in the heart rate variability between the older subjects and the younger subjects. This supports the finding of Snook (1965) who reports no increase in heart rate with increasing age while performing work at a fixed level. Brouha (1962) also concluded that the heart rate of the workers increases under stressful conditions imposed as for example by hot and humid environments. In light of the previous findings it could be said that under normal working conditions, i.e. in the absence of hot, humid or other extenuating environments, there is no significant difference in heart rate variability between older and younger workers while performing work at different levels of information load and task difficulty.

b) No significant effect was found for the information load on heart rate ($p < 0.05$). Figure 5.14 shows that older subjects, but not younger ones, experienced higher increase in heart rate with the increase of information load but the increase was not significant. The non significant effect that was found for the information load on heart rate could be because of the task being self paced. Thus, an increase in the information load did not increase the stress on the subject but only affected his performance time.

c) Clearance between the pin and the hole had a significant effect on heart rate for both older and younger subjects ($p < 0.05$). Figure 5.13 shows that when the clearance decreased from C1 = 0.75" to C4 = 0.008" the heart rate increased for both groups. Heart rate increase was higher for the older group than for the younger group at each level of clearance, but the difference was not significant. These findings indicate that increasing the task difficulty has a direct effect on the heart rate increase. Since the task used in this study was not physically demanding, it seems that the effect of task difficulty was on the mental load, which has a direct effect on heart rate variability (Young, 1956; Kalsbeek, 1971).

CHAPTER VII

CONCLUSIONS

On the basis of the analysis of data it has been observed that for tasks requiring both decision making and the movement functions, older workers are significantly slower in their responses than the younger workers. However, the relative effects of age on the decision and movement times are different. Decision time for the older group is, on the average, 63% longer than that for the younger group, while average movement time for the older group is 22% longer than that for the younger group. The findings of Szafran (1951) and Singleton (1954) further substantiate the above results. Using reaction time as an indicator of decision time, they found that age had a proportionately greater effect on reaction time rather than movement time. However, Pierson and Monotoye (1958) and Tolin and Simon (1968) report that movement rather than reaction time is more affected by age. In the experiments of Pierson and of Tolin the subjects could anticipate the location of the stimulus thus preparing the subject for movement in a particular direction. It could thus be inferred that, in the absense of anticipation and foreknowledge of the location of a stimulus, the decision making activity takes longer and is thus more affected by age than is movement time. Welford (1962) also points out that older subjects perform relatively well when the actual signal can be anticipated.

The difference in decision time between the older and the younger subjects could be attributed mostly to a slowing of the perceptual cerebral, and motor functions. The present study also shows that, with an increase in the information load, decision time increased by a greater amount for the older group than for the younger group.

The most important suggestion arising from the decision time models is that decision time could be affected by the arrangement of the task alternatives. This finding could be a useful tool in the hand of the industrial engineer who is dealing with job redesign. However, more studies are needed to investigate this suggestion in order to find how the layout of the items of the task could affect the decision process.

The non significant interactions between age and information content in the movement time models indicated that increasing the information content of the task had no effect on the difference between the older and the younger subjects in movement time. The significant effect of the clearance on movement time and the non-significant interaction between age and clearance suggest that both older and younger subjects encountered the same difficulty in positioning the pin into the hole when the clearance was decreased. In light of these findings it is being suggested that until the fifties and the early sixties, the ageing process does not have a significant effect on the cortical function exercising control over the motor functions.

Analysis of the performance errors indicates that the slowing among the older subjects was not observed at the expense of accuracy. More investigations are needed in this area to study the effect of age on the accuracy of performance in dealing with modern systems under paced and unpaced conditions and under time stress. This could be done either through simulation or actual on-site tasks.

The study provided no evidence that age has an effect on heart rate variability of the worker under different levels of task difficulty and information load. In light of this finding it is being suggested that no additional stresses could possibly be imposed upon the older worker should the complexity of the task be increased. However, it should be noted that such factors as temperature, humidity, impervious clothing, motivation, emotional state, fatigue, and training have all been found to affect the heart rate (Kalsbeek, 1971; Brouha, 1962).

In view of the results of the present study, it is being suggested that other aspects regarding the performance of the older workers also be investigated.

The following are suggested:

1. Field studies for the effect of ageing on the accuracy of performance in dealing with modern systems, under paced and unpaced conditions and under time stress.

2. Study of the effect of the task layout on the decision time and how it could affect the slowing among the older workers.

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APPENDIX A

A.1 Instructions to the Subjects

The subject was seated in front of the signal response unit with the center line of the unit aligned to the center line of his body, at a height such that his lower right arm was in a horizontal position while touching the pin in the pin-pocket. The distance from the equipment was such as to enable him to reach hole number one at the far left corner without moving his shoulder. The three electrodes of the heart rate recording unit were connected to the subject's chest in a way such that they did not interfere with his performance of the task.

After recording the heart beats of the subject at rest, instructions were given to him to perform the task according to the following steps:

1. Remove the pin from the pin-pocket with the right hand thumb and index finger.
2. Detect the number shown on the screen and select the corresponding hole.
3. Move pin to the hole in a smooth straight line motion.
4. Insert pin into hole.
5. Release pin.
6. Assume starting position again.

A.2 Duration of the Experimental Conditions and the Rest Periods

The time limits for each run of the experiment were assigned such that it was sufficient to collect about 55 performance times for each condition, that is 220 cycles per experimental run. It was found that 13 minutes duration for each run was enough to collect this amount of data. The heart rate was recorded for 10 minutes during the performance of the assigned six runs.

After each condition a rest period of 5 minutes was given to the subject and two rest periods of 15 minutes each were given after the performance of 4 and 8 conditions. The total time of the experiment was 5 hours including the learning session.

APPENDIX B

- Sample of Part of the Results of the Test for Normality.

- Symbols used in the computer programme

PERT ≡	Performance Time	(PT)
DECT ≡	Decision Time	(DT)
MOVT ≡	Movement Time	(MT)

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 1

G=1 S=1 C=1 H=2 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1236	.15	0.453	1.213	0.225	0.634	0.865	0.387	943.2250	117.5594
DECT	40	0.0770	>.20	-0.109	-0.291	0.771	-0.689	-0.940	0.347	270.4000	37.5266
MOVT	40	0.1227	.15	0.649	1.736	0.083	-0.146	-0.199	0.842	672.8250	116.5508

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 2

G=1 S=1 C=1 H=2 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1433	.05	0.809	2.165	0.030	0.165	0.225	0.822	1066.7500	125.0585
DECT	40	0.1117	>.20	0.624	1.671	0.095	0.475	0.649	0.517	266.3500	38.1048
MOVT	40	0.1341	.10	0.651	1.741	0.082	-0.020	-0.028	0.978	800.4000	113.5022

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 3

G=1 S=1 C=1 H=2 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1012	>.20	0.291	0.779	0.436	-0.313	-0.427	0.669	1134.6000	152.4211
DECT	40	0.1110	>.20	0.806	2.156	0.031	0.382	0.521	0.602	259.4750	43.5584
MOVT	40	0.1083	>.20	0.186	0.498	0.618	-0.784	-1.071	0.284	875.1250	136.1382

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 4

G=1 S=1 C=1 H=2 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0579	>.20	0.379	1.013	0.311	-0.492	-0.672	0.502	1251.4000	99.9569
DECT	40	0.1110	>.20	-0.280	-0.750	0.453	-0.808	-1.102	0.270	269.9250	36.7566
MOVT	40	0.0741	>.20	0.377	1.010	0.313	0.174	0.238	0.812	981.4750	100.4306

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   5

G=1 S=1 C=1 H=3 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0772	>.20	0.127	0.340	0.734	-0.446	-0.609	0.543	1059.5750	156.2373
DECT	40	0.0938	>.20	-0.093	-0.249	0.803	0.888	1.212	0.225	345.6750	43.6774
MOVT	40	0.0667	>.20	-0.140	-0.374	0.709	-0.209	-0.285	0.776	713.9000	147.8165

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   6

G=1 S=1 C=1 H=3 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1427	.05	0.404	1.081	0.280	-0.343	-0.468	0.640	1152.9000	114.6470
DECT	40	0.1296	>.20	-0.587	-1.569	0.117	1.486	2.028	0.043	344.6000	35.4508
MOVT	40	0.1434	.05	0.389	1.041	0.298	-0.787	-1.075	0.282	808.3000	112.9298

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   7

G=1 S=1 C=1 H=3 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0545	>.20	0.005	0.013	0.989	-0.557	-0.760	0.447	1215.4250	134.1447
DECT	40	0.1206	.20	-0.106	-0.283	0.777	0.178	0.243	0.808	328.6500	41.0906
MOVT	40	0.0655	>.20	0.413	1.105	0.269	0.226	0.308	0.758	886.7750	129.5654

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   8

G=1 S=1 C=1 H=3 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1297	.10	0.014	0.037	0.970	0.098	0.134	0.894	1276.2500	115.5801
DECT	40	0.1466	.05	0.083	0.222	0.824	2.535	3.460	0.001	354.3000	47.8594
MOVT	40	0.1298	>.20	-0.222	-0.593	0.553	1.236	1.687	0.092	521.9500	127.5709

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   9

G=1   S=1   C=1   H=4   D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.2435	.01	0.586	1.567	0.117	-0.868	-1.185	0.236	1187.1500	217.8721
DECT	40	0.1735	.01	1.175	3.145	0.002	0.769	1.050	0.294	367.4750	135.4829
MOVT	40	0.1371	.10	0.863	2.310	0.021	0.745	1.017	0.309	819.6750	172.0836

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   10

G=1   S=1   C=1   H=4   D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1825	.01	0.291	0.779	0.436	-0.527	-0.719	0.472	1177.0000	151.1506
DECT	40	0.1341	.10	0.520	1.392	0.164	0.069	0.095	0.925	394.4000	109.5297
MOVT	40	0.1813	.01	1.006	2.691	0.007	1.500	2.048	0.041	782.6000	137.1667

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   11

G=1   S=1   C=1   H=4   D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1620	.05	2.722	7.282	0.000	11.864	16.194	0.000	1286.3000	222.3379
DECT	40	0.1081	>.20	0.876	2.344	0.019	2.287	3.121	0.002	384.0750	94.5449
MOVT	40	0.2154	.01	1.448	3.873	0.000	3.944	5.383	0.000	902.2250	195.5315

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   12

G=1   S=1   C=1   H=4   D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1518	.01	1.343	3.593	0.000	3.892	5.313	0.000	1270.5500	105.4645
DECT	40	0.1411	.05	0.733	1.960	0.050	0.205	0.280	0.780	367.6250	99.9207
MOVT	40	0.1530	.05	-0.539	-1.419	0.156	0.586	0.800	0.424	902.9250	143.2300

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 13

G=1 S=1 C=2 H=2 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1640	.01	0.204	0.545	0.586	-0.535	-0.730	0.465	906.3250	102.1149
DECT	40	0.1035	>.20	0.013	0.034	0.973	-0.284	-0.387	0.699	268.8250	36.0860
MOVT	40	0.1675	.01	0.854	2.285	0.022	-0.248	-0.338	0.735	637.5000	103.1837

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 14

G=1 S=1 C=2 H=2 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1798	.01	1.069	2.860	0.004	1.397	1.908	0.056	1015.5500	87.3578
DECT	40	0.0952	>.20	0.387	1.036	0.300	-0.358	-0.489	0.625	249.8250	28.3276
MOVT	40	0.1470	.05	0.748	2.001	0.045	1.251	1.707	0.088	765.7250	92.6983

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 15

G=1 S=1 C=2 H=2 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.2800	.01	1.715	4.589	0.000	1.871	2.554	0.011	1088.3250	138.6137
DECT	40	0.0970	>.20	0.476	1.273	0.203	-0.210	-0.287	0.774	260.4250	36.8746
MOVT	40	0.2131	.01	1.324	3.542	0.000	1.074	1.465	0.143	827.9000	144.2356

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 16

G=1 S=1 C=2 H=2 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1315	.10	0.054	0.144	0.885	-0.022	-0.030	0.976	1188.9750	65.3054
DECT	40	0.1528	.05	0.742	1.986	0.047	-0.243	-0.332	0.740	251.0750	36.0302
MOVT	40	0.1078	>.20	-0.009	-0.022	0.983	0.211	0.288	0.773	937.9000	63.9109

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 17

G=1 S=1 C=2 H=3 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1568	.05	0.987	2.640	0.008	0.366	0.499	0.618	962.4250	111.6698
DECT	40	0.1542	.05	0.569	1.519	0.129	0.699	0.954	0.340	340.4750	33.2303
MOVT	40	0.1936	.01	0.830	2.220	0.026	0.412	0.562	0.574	621.9500	111.3548

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 18

G=1 S=1 C=2 H=3 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1630	.01	1.713	4.584	0.000	4.380	5.978	0.000	1042.0750	89.9257
DECT	40	0.1079	>.20	-0.673	-1.800	0.072	1.144	1.561	0.118	336.7000	38.4569
MOVT	40	0.1318	.10	1.192	3.188	0.001	1.841	2.513	0.012	705.3750	98.5291

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 19

G=1 S=1 C=2 H=3 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0879	>.20	0.049	0.132	0.895	0.029	0.039	0.969	1169.2500	96.2531
DECT	40	0.1126	>.20	-0.983	-2.629	0.009	1.180	1.610	0.107	318.0250	36.6126
MOVT	40	0.0558	>.20	-0.003	-0.008	0.994	0.065	0.088	0.930	851.2250	108.0407

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 20

G=1 S=1 C=2 H=3 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0836	>.20	0.584	1.563	0.118	0.463	0.632	0.528	1262.2000	127.6530
DECT	40	0.0814	>.20	0.666	1.782	0.075	1.159	1.570	0.116	347.0250	33.9792
MOVT	40	0.0744	>.20	0.359	0.959	0.337	0.164	0.224	0.823	915.1750	128.3504

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 21

G=1 S=1 C=2 H=4 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1566	.05	1.236	3.307	0.001	1.758	2.399	0.016	1166.6250	197.9839
DECT	40	0.1532	.05	0.861	2.303	0.021	0.670	0.915	0.360	376.3000	77.5580
MOVT	40	0.2495	.01	1.333	3.566	0.000	1.274	1.739	0.082	810.3250	218.4759

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 22

G=1 S=1 C=2 H=4 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1719	.01	0.913	2.444	0.015	0.538	0.734	0.463	1302.4000	194.7088
DECT	40	0.1265	.15	0.061	0.163	0.871	-1.020	-1.393	0.164	328.8250	65.9218
MOVT	40	0.1174	.20	0.502	1.342	0.180	0.271	0.370	0.711	973.5750	203.9445

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 23

G=1 S=1 C=2 H=4 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1547	.05	-0.390	-1.042	0.297	-0.272	-0.371	0.710	1317.3750	88.6528
DECT	40	0.2237	.01	1.320	3.532	0.000	1.414	1.930	0.054	366.7750	95.1454
MOVT	40	0.2833	.01	-0.741	-1.981	0.048	-0.830	-1.132	0.257	950.6000	153.9761

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 24

G=1 S=1 C=2 H=4 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1648	.01	1.324	3.542	0.000	1.955	2.669	0.008	1322.4500	85.3493
DECT	40	0.1808	.01	0.965	2.582	0.010	0.777	1.061	0.289	374.6250	112.6908
MOVT	40	0.1577	.05	-0.823	-2.203	0.028	0.841	1.148	0.251	947.6250	133.2889

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 25

G=1 S=1 C=3 H=2 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1083	>.20	-0.007	-0.018	0.985	-0.387	-0.528	0.598	855.3750	74.8858
DECT	40	0.1394	.10	0.424	1.133	0.257	-1.072	-1.464	0.143	250.8250	37.0764
MOVT	40	0.1370	.10	0.119	0.318	0.750	-0.296	-0.404	0.686	604.5500	90.8597

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 26

G=1 S=1 C=3 H=2 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1113	>.20	-0.531	-1.420	0.156	-0.009	-0.013	0.990	948.2750	33.6696
DECT	40	0.1357	.10	0.234	0.626	0.531	-1.005	-1.372	0.170	264.9250	37.7905
MOVT	40	0.1413	.05	-0.028	-0.075	0.940	-0.326	-0.446	0.656	683.3500	56.4644

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 27

G=1 S=1 C=3 H=2 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1555	.05	0.369	0.988	0.323	-0.156	-0.212	0.832	1057.6250	68.4677
DECT	40	0.1348	.10	0.297	0.794	0.427	-0.647	-0.883	0.377	263.5000	36.5471
MOVT	40	0.1782	.01	0.362	0.968	0.333	0.244	0.333	0.739	794.1250	68.2669

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 28

G=1 S=1 C=3 H=2 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1451	.05	0.291	0.778	0.437	-0.419	-0.572	0.567	1184.1750	108.5026
DECT	40	0.1707	.01	0.815	2.179	0.029	1.047	1.429	0.153	278.4750	48.3560
MOVT	40	0.2084	.01	-0.296	-0.791	0.429	0.178	0.243	0.808	905.7000	93.4296

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   29

G=1   S=1   C=3   H=3   D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.2055	.01	-0.365	-0.576	0.329	1.097	1.498	0.134	1082.5500	55.1835
DECT	40	0.1443	.05	-0.315	0.040	0.968	0.142	0.194	0.846	331.6500	58.3897
MOVT	40	0.1263	.15	-1.091	-2.918	0.004	2.444	3.337	0.001	750.9000	122.9646

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   30

G=1   S=1   C=3   H=3   D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1732	.01	0.259	0.692	0.489	-1.410	-1.924	0.054	1381.6250	209.3224
DECT	40	0.1321	.10	0.177	0.474	0.636	0.030	0.040	0.968	325.3000	61.0335
MOVT	40	0.1276	.19	0.283	0.756	0.449	-1.106	-1.509	0.131	1056.3250	203.6955

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   31

G=1   S=1   C=3   H=3   D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1745	.01	0.914	2.444	0.015	1.544	2.107	0.035	1425.6750	122.3616
DECT	40	0.3961	.01	3.215	8.600	0.000	10.005	13.656	0.000	407.8000	222.7803
MOVT	40	0.1785	.01	-2.194	-5.869	0.000	5.894	8.046	0.000	1017.8750	183.8814

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   32

G=1   S=1   C=3   H=3   D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1279	.10	0.226	0.605	0.545	-0.955	-1.303	0.192	1428.7000	87.0597
DECT	40	0.1929	.01	1.525	4.079	0.000	4.178	5.703	0.000	359.8000	94.3265
MOVT	40	0.0940	>.20	0.099	0.241	0.810	-0.787	-1.074	0.283	1068.9000	98.3702

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 33
G=1 S=1 C=3 H=4 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1166	.20	0.720	1.926	0.054	0.865	1.181	0.238	1052.9000	125.1737
DECT	40	0.1104	>.20	0.680	1.819	0.069	0.340	0.464	0.643	455.3500	47.7958
MOVT	40	0.1203	.20	0.633	1.694	0.090	0.132	0.180	0.857	597.5500	114.6215

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 34
G=1 S=1 C=3 H=4 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1249	.15	-0.015	-0.040	0.968	-0.224	-0.306	0.759	1090.5250	92.4518
DECT	40	0.1722	.01	-0.149	-0.400	0.689	1.325	1.808	0.071	429.4750	64.8545
MOVT	40	0.1298	.10	-0.109	-0.288	0.773	0.530	0.724	0.469	661.0500	87.3733

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 35
G=1 S=1 C=3 H=4 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1014	>.20	0.583	1.561	0.119	-0.132	-0.181	0.857	1222.9500	102.6919
DECT	40	0.1344	.10	0.651	1.742	0.081	1.106	1.510	0.131	459.4250	41.0883
MOVT	40	0.1537	.05	0.491	1.315	0.189	0.386	0.527	0.598	763.5250	92.1634

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 36
G=1 S=1 C=3 H=4 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1465	.05	0.853	2.281	0.023	0.444	0.606	0.544	1279.5750	60.4566
DECT	40	0.1130	>.20	-0.461	-1.232	0.218	0.121	0.165	0.869	440.1750	60.5635
MOVT	40	0.0788	>.20	0.376	1.006	0.314	-0.117	-0.160	0.873	839.8000	78.8420

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   37

G=1 S=1 C=4 H=2 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0503	>.20	0.198	0.530	0.596	-0.244	-0.334	0.739	1179.0000	115.4712
DECT	40	0.1336	.10	0.748	2.001	0.045	-0.147	-0.201	0.841	264.9000	39.7794
MOVT	40	0.1221	.15	-0.042	-0.112	0.911	0.378	0.517	0.605	914.1000	112.6944

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   38

G=1 S=1 C=4 H=2 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1612	.05	0.274	0.733	0.463	-1.223	-1.669	0.095	1190.1750	109.7337
DECT	40	0.1233	.15	0.312	0.834	0.404	-0.028	-0.039	0.969	276.8250	40.1656
MOVT	40	0.1334	.10	0.252	0.674	0.500	-1.162	-1.586	0.113	913.3500	110.9476

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   39

G=1 S=1 C=4 H=2 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1555	.05	1.217	3.256	0.001	1.447	1.975	0.048	1288.1500	140.2769
DECT	40	0.1321	.10	0.209	0.560	0.575	-0.628	-0.857	0.392	268.5500	46.5111
MOVT	40	0.1334	.10	0.809	2.140	0.032	0.228	0.311	0.756	1019.6000	150.5514

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   40

G=1 S=1 C=4 H=2 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1692	.01	0.107	0.287	0.774	-0.821	-1.121	0.262	1381.3750	101.0630
DECT	40	0.1144	>.20	0.549	1.469	0.142	-0.494	-0.675	0.500	260.9000	40.2771
MOVT	40	0.0793	>.20	-0.318	-0.852	0.394	-0.466	-0.636	0.525	1120.4750	59.9105

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   41

G=1   S=1   C=4   H=3   D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1688	.01	0.961	2.572	0.010	0.417	0.569	0.569	1262.6250	221.9056
DECT	40	0.1256	.15	-0.528	-1.413	0.158	0.713	0.974	0.330	410.5500	49.8757
MOVT	40	0.1685	.01	1.101	2.945	0.003	0.804	1.097	0.273	852.0750	210.6686

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   42

G=1   S=1   C=4   H=3   D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1783	.01	0.621	1.660	0.097	-0.092	-0.125	0.900	1217.8250	103.7623
DECT	40	0.1032	>.20	0.256	0.685	0.494	0.008	0.011	0.991	404.4500	61.0439
MOVT	40	0.1076	>.20	0.645	1.727	0.084	-0.073	-0.100	0.921	813.3750	88.8380

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   43

G=1   S=1   C=4   H=3   D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1257	.15	-0.199	-0.529	0.597	2.844	3.882	0.000	1338.6250	100.6894
DECT	40	0.1596	.05	0.167	0.446	0.656	1.260	1.720	0.085	385.1750	54.2789
MOVT	40	0.1333	.10	0.561	1.500	0.134	0.258	0.352	0.725	953.6500	100.5478

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   44

G=1   S=1   C=4   H=3   D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1607	.05	0.899	2.406	0.016	1.642	2.242	0.025	1490.6500	113.9906
DECT	40	0.1047	>.20	0.092	0.247	0.805	0.037	0.050	0.960	424.6750	55.6433
MOVT	40	0.1039	>.20	0.922	2.466	0.014	0.908	1.239	0.215	1065.9750	140.7688

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1881	.01	0.797	2.131	0.033	-0.175	-0.239	0.811	1370.3250	176.5482
DECT	40	0.1007	>.20	-0.416	-1.112	0.266	0.377	0.514	0.607	475.1250	68.1481
MOVT	40	0.1535	.05	0.684	1.829	0.067	-0.631	-0.861	0.389	895.2000	155.0523

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   46

G=1 S=1 C=4 H=4 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1766	.01	1.396	3.735	0.000	1.644	2.244	0.025	1389.6500	157.9234
DECT	40	0.0926	>.20	0.737	1.972	0.049	1.215	1.659	0.097	471.3500	67.9757
MOVT	40	0.1428	.05	1.227	3.283	0.001	1.485	2.027	0.043	918.5000	144.0757

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   47

G=1 S=1 C=4 H=4 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0885	>.20	1.263	3.380	0.001	3.127	4.269	0.000	1472.5000	158.2463
DECT	40	0.1238	.15	0.439	1.175	0.240	1.765	2.410	0.016	471.0500	70.8277
MOVT	40	0.0804	>.20	0.656	1.755	0.079	0.724	0.988	0.323	1001.4500	133.4871

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   48

G=1 S=1 C=4 H=4 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1768	.01	1.248	3.339	0.001	1.226	1.674	0.094	1487.5250	128.2851
DECT	40	0.1631	.01	1.001	2.677	0.007	0.923	1.260	0.208	467.6250	89.2822
MOVT	40	0.0600	>.20	0.033	0.089	0.929	0.428	0.584	0.559	1019.9000	135.3551

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   45

G=1   S=1   C=4   H=4   D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1881	.01	0.797	2.131	0.033	-0.175	-0.239	0.811	1370.3250	176.5482
DECT	40	0.1007	>.20	-0.416	-1.112	0.266	0.377	0.514	0.607	475.1250	68.1481
MOVT	40	0.1535	.05	0.684	1.829	0.067	-0.631	-0.861	0.389	895.2000	155.0523

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   46

G=1   S=1   C=4   H=4   D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1766	.01	1.396	3.735	0.000	1.644	2.244	0.025	1389.8500	157.9234
DECT	40	0.0926	>.20	0.737	1.972	0.049	1.215	1.659	0.097	471.3500	67.9757
MOVT	40	0.1428	.05	1.227	3.283	0.001	1.485	2.027	0.043	918.5000	144.0757

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   47

G=1   S=1   C=4   H=4   D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0885	>.20	1.263	3.380	0.001	3.127	4.269	0.000	1472.5000	158.2463
DECT	40	0.1238	.15	0.439	1.175	0.240	1.765	2.410	0.016	471.0500	70.8277
MOVT	40	0.0804	>.20	0.656	1.755	0.079	0.724	0.988	0.323	1001.4500	133.4871

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   48

G=1   S=1   C=4   H=4   D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1768	.01	1.248	3.339	0.001	1.226	1.674	0.094	1487.5250	128.2851
DECT	40	0.1631	.01	1.001	2.677	0.007	0.923	1.260	0.208	467.6250	89.2822
MOVT	40	0.0602	>.20	0.033	0.089	0.929	0.428	0.584	0.559	1019.9000	135.3551

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978 481

G=2 S=1 C=1 H=2 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1530	.05	0.837	2.239	0.025	0.206	0.282	0.778	949.5750	74.0138
DECT	40	0.1504	.05	-0.295	-0.789	0.430	-0.608	-0.830	0.407	506.7750	40.2935
MOVT	40	0.1547	.05	0.957	2.561	0.010	0.151	0.206	0.837	442.8000	72.3553

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978 482

G=2 S=1 C=1 H=2 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1510	.05	1.741	4.658	0.000	5.292	7.224	0.000	1038.2250	72.5960
DECT	40	0.1093	>.20	0.214	0.572	0.567	-0.650	-0.888	0.375	481.4250	32.7632
MOVT	40	0.2159	.01	1.771	4.737	0.000	5.770	7.876	0.000	556.8000	58.4721

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978 483

G=2 S=1 C=1 H=2 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.2208	.01	1.827	4.889	0.000	2.256	3.079	0.002	1257.3150	428.6107
DECT	40	0.4171	.01	2.247	6.012	0.000	3.401	4.642	0.000	664.9250	466.5386
MOVT	40	0.1716	.01	0.895	2.394	0.017	0.058	0.079	0.937	692.4500	164.1625

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978 484

G=2 S=1 C=1 H=2 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.2274	.01	0.960	2.567	0.010	-0.551	-0.752	0.452	1455.0500	328.8324
DECT	40	0.3273	.01	2.071	5.541	0.000	2.916	3.981	0.000	554.7000	185.3671
MOVT	40	0.2469	.01	0.869	2.325	0.020	-0.293	-0.400	0.689	900.3500	220.1110

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   485

G=2 S=1 C=1 H=3 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1772	.01	0.740	1.979	0.048	4.185	5.712	0.000	1100.0500	167.3162
DECT	40	0.2009	.01	-0.264	-0.708	0.479	0.348	0.475	0.634	584.6500	157.1831
MOVT	40	0.0724	>.20	0.299	0.801	0.423	0.072	0.099	0.921	515.4000	87.6303

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   486

G=2 S=1 C=1 H=3 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.2205	.01	3.430	9.176	0.000	16.721	22.824	0.000	1289.8500	164.0685
DECT	40	0.1757	.01	0.873	2.335	0.020	0.318	0.435	0.664	623.9000	81.9392
MOVT	40	0.2204	.01	1.884	5.040	0.000	7.696	10.505	0.000	665.5500	148.2406

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   487

G=2 S=1 C=1 H=3 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1265	.15	-1.168	-3.125	0.002	4.151	5.666	0.000	1339.2000	59.3552
DECT	40	0.1264	.15	0.123	0.329	0.742	0.410	0.560	0.575	601.0500	46.5761
MOVT	40	0.1378	.10	0.106	0.284	0.776	0.129	0.176	0.861	738.1500	59.1029

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   488

G=2 S=1 C=1 H=3 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1044	>.20	0.353	0.946	0.344	0.558	0.762	0.446	1441.0750	168.2617
DECT	40	0.1044	>.20	0.366	0.980	0.327	-0.573	-0.783	0.434	611.7000	63.6558
MOVT	40	0.1425	.05	0.659	1.764	0.078	0.064	0.087	0.930	829.3750	148.9358

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 489

G=2 S=1 C=1 H=4 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1813	.01	0.794	2.123	0.034	-0.193	-0.264	0.792	1151.3250	216.1240
DECT	40	0.2403	.01	0.784	2.097	0.036	-0.621	-0.848	0.397	589.1000	182.8701
MOVT	40	0.2356	.01	0.832	2.226	0.026	-0.308	-0.421	0.674	562.2250	113.0907

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 490

G=2 S=1 C=1 H=4 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1827	.01	0.394	1.053	0.292	0.172	0.235	0.815	1428.1500	170.7450
DECT	40	0.1402	.05	0.338	0.903	0.366	1.334	1.821	0.069	805.1500	92.6816
MOVT	40	0.1960	.01	1.285	3.438	0.001	0.954	1.303	0.193	623.0000	125.3567

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 491

G=2 S=1 C=1 H=4 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.2206	.01	1.061	2.840	0.005	-0.187	-0.256	0.798	1494.9250	176.9886
DECT	40	0.2406	.01	-1.124	-3.007	0.003	1.732	2.365	0.018	792.9500	161.3976
MOVT	40	0.2258	.01	1.231	3.292	0.001	0.726	0.991	0.321	701.9750	169.7209

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 492

G=2 S=1 C=1 H=4 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1577	.05	0.175	0.467	0.640	-1.378	-1.881	0.060	1312.2000	91.8148
DECT	40	0.1173	.20	-0.593	-1.346	0.178	0.632	0.863	0.388	617.0500	97.3671
MOVT	40	0.2653	.01	1.611	4.311	0.000	3.098	4.229	0.000	695.1500	125.0863

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 493

G=2 S=1 C=2 H=2 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1210	.20	-0.005	-0.014	0.987	-0.508	-0.693	0.488	926.2250	62.8300
DECT	40	0.1652	.01	0.848	2.268	0.023	1.671	2.280	0.023	435.7000	54.2842
MOVT	40	0.1323	.10	0.550	1.494	0.135	-0.134	-0.183	0.855	490.5250	57.0870

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 494

G=2 S=1 C=2 H=2 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1766	.01	1.243	3.325	0.001	4.223	5.764	0.000	974.1000	63.2933
DECT	40	0.1607	.05	-0.890	-2.381	0.017	0.922	1.259	0.208	404.1500	38.0145
MOVT	40	0.1396	.10	1.043	2.789	0.005	1.361	1.857	0.063	569.9500	49.2518

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 495

G=2 S=1 C=2 H=2 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1762	.01	1.211	3.239	0.001	0.591	0.807	0.420	1115.8250	107.4974
DECT	40	0.1213	.20	-0.384	-1.027	0.304	0.410	0.559	0.576	425.5250	49.7414
MOVT	40	0.1949	.01	1.090	2.916	0.004	0.939	1.281	0.200	690.3000	91.6253

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 496

G=2 S=1 C=2 H=2 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0916	>.20	0.341	0.914	0.361	0.398	0.544	0.587	1098.5000	68.3314
DECT	40	0.1227	.15	-0.029	-0.078	0.938	0.852	1.162	0.245	409.9500	38.4020
MOVT	40	0.1370	.10	0.209	0.534	0.593	-0.220	-0.300	0.764	688.5500	45.4470

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 497

G=2 S=1 C=2 H=3 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0865	>.20	-0.120	-0.321	0.748	1.355	1.850	0.064	1321.0750	131.4447
DECT	40	0.0905	>.20	0.312	0.836	0.403	1.028	1.404	0.160	686.1500	156.0326
MOVT	40	0.1733	.01	0.001	0.003	0.998	0.824	1.125	0.261	634.9250	176.4429

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 498

G=2 S=1 C=2 H=3 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1568	.05	1.172	3.135	0.002	1.230	1.679	0.093	1451.4000	134.2672
DECT	40	0.1691	.01	0.829	2.218	0.027	2.260	3.086	0.002	726.3500	150.0592
MOVT	40	0.1724	.01	0.475	1.272	0.203	0.662	0.903	0.366	725.0500	158.4310

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 499

G=2 S=1 C=2 H=3 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1279	.10	-0.075	-0.201	0.841	0.832	1.136	0.256	1463.3750	150.6585
DECT	40	0.1044	>.20	0.160	0.427	0.669	1.011	1.380	0.167	688.9000	95.5182
MOVT	40	0.1511	.05	1.254	3.355	0.001	2.019	2.755	0.006	774.4750	118.8293

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 500

G=2 S=1 C=2 H=3 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1488	.05	1.465	3.918	0.000	3.206	4.377	0.000	1525.8000	168.1753
DECT	40	0.1609	.01	0.713	1.908	0.056	1.149	1.568	0.117	694.0250	146.4442
MOVT	40	0.1040	>.20	0.347	0.928	0.353	0.789	1.078	0.281	831.7750	132.5684

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 501

G=2 S=1 C=2 H=4 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1870	.01	0.382	1.021	0.307	-0.467	-0.638	0.523	1242.8000	79.3021
DECT	40	0.1579	.05	0.250	0.669	0.504	-1.028	-1.403	0.161	711.0000	76.5523
MOVT	40	0.1382	.10	-0.105	-0.280	0.780	-0.990	-1.352	0.176	531.8000	62.2835

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 502

G=2 S=1 C=2 H=4 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.2094	.01	0.606	1.622	0.105	2.596	3.543	0.000	1421.6500	101.8940
DECT	40	0.2328	.01	-1.348	-3.606	0.000	0.901	1.230	0.219	803.7500	86.9352
MOVT	40	0.2675	.01	1.601	4.284	0.000	1.318	1.799	0.072	617.9000	123.8762

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 503

G=2 S=1 C=2 H=4 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1499	.05	-0.581	-1.553	0.120	-0.005	-0.007	0.994	1475.4000	66.6452
DECT	40	0.1186	.20	0.119	0.317	0.751	-0.006	-0.009	0.993	839.7500	69.6654
MOVT	40	0.1343	.10	-0.518	-1.386	0.166	-0.553	-0.755	0.450	635.6500	62.1675

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 504

G=2 S=1 C=2 H=4 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0862	>.20	-0.040	-0.108	0.914	-0.892	-1.218	0.223	1422.3500	119.2563
DECT	40	0.1150	>.20	0.105	0.282	0.778	-0.731	-0.998	0.318	757.6500	71.4891
MOVT	40	0.1741	.01	1.122	3.003	0.003	0.369	0.504	0.614	664.7000	106.5970

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 505

G=2 S=1 C=3 H=2 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1519	.05	1.284	3.436	0.001	2.331	3.181	0.001	995.3000	98.5058
DECT	40	0.1630	.01	0.757	2.026	0.043	-0.211	-0.288	0.773	398.7250	86.4879
MOVT	40	0.1275	.10	0.920	2.463	0.014	1.314	1.793	0.073	596.5750	72.5460

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 506

G=2 S=1 C=3 H=2 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0956	>.20	0.637	1.705	0.088	-0.050	-0.068	0.946	1067.1500	65.3093
DECT	40	0.0789	>.20	-0.181	-0.485	0.628	-0.317	-0.433	0.665	387.4500	56.9295
MOVT	40	0.1260	.15	-0.643	-1.721	0.085	3.200	4.368	0.000	679.7000	28.8508

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 507

G=2 S=1 C=3 H=2 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1501	.05	1.150	3.078	0.002	2.781	3.796	0.000	1154.6750	102.2955
DECT	40	0.1089	>.20	-0.174	-0.466	0.641	-0.068	-0.093	0.926	365.2750	57.6430
MOVT	40	0.2179	.01	1.475	3.945	0.000	4.347	5.933	0.000	789.4000	101.6756

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 508

G=2 S=1 C=3 H=2 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1576	.05	1.077	2.883	0.004	3.047	4.160	0.000	1318.5000	134.4440
DECT	40	0.2364	.01	1.721	4.604	0.000	3.700	5.051	0.000	413.7250	87.5440
MOVT	40	0.2195	.01	2.422	6.480	0.000	11.916	16.265	0.000	904.7750	128.3595

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 509

G=2 S=1 C=3 H=3 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1543	.05	1.022	2.735	0.006	0.878	1.199	0.231	1177.3250	179.6598
DECT	40	0.1132	>.20	-0.083	-0.221	0.825	-0.314	-0.428	0.669	620.9750	68.3676
MOVT	40	0.2308	.01	1.042	2.788	0.005	-0.007	-0.009	0.993	556.3500	148.0165

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 510

G=2 S=1 C=3 H=3 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1444	.05	1.070	2.862	0.004	1.192	1.627	0.104	1224.4000	151.2965
DECT	40	0.1067	>.20	0.252	0.675	0.500	1.749	2.388	0.017	622.6000	166.2463
MOVT	40	0.2478	.01	1.354	3.623	0.000	1.284	1.753	0.080	601.8000	103.7492

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 511

G=2 S=1 C=3 H=3 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1760	.01	0.889	2.378	0.017	0.602	0.821	0.412	1265.8250	111.3085
DECT	40	0.1040	>.20	0.702	1.878	0.060	1.432	1.954	0.051	627.5000	103.5061
MOVT	40	0.1294	.10	0.594	1.588	0.112	-0.092	-0.125	0.900	637.9250	71.4858

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 512

G=2 S=1 C=3 H=3 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1182	.20	0.546	1.461	0.144	-0.374	-0.511	0.609	1377.7750	181.4206
DECT	40	0.2925	.01	1.102	2.948	0.003	0.052	0.071	0.943	626.1750	104.7607
MOVT	40	0.1232	.15	0.371	0.993	0.321	-0.762	-1.040	0.298	751.6000	157.7443

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 513

G=2 S=1 C=3 H=4 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1726	.01	1.004	2.685	0.007	0.653	0.892	0.373	1219.7750	207.8541
DECT	40	0.1866	.01	-0.385	-1.030	0.303	0.406	0.554	0.580	629.2750	166.9234
MOVT	40	0.2116	.01	1.419	3.795	0.000	1.180	1.610	0.107	590.5000	167.9284

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 514

G=2 S=1 C=3 H=4 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1678	.01	0.879	2.351	0.019	0.579	0.791	0.429	1377.9750	130.3471
DECT	40	0.1055	>.20	-0.805	-2.152	0.031	1.171	1.599	0.110	736.3750	142.9240
MOVT	40	0.2062	.01	0.954	2.552	0.011	-0.196	-0.267	0.789	641.6000	140.7222

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 515

G=2 S=1 C=3 H=4 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1913	.01	1.573	4.208	0.000	2.645	3.611	0.000	1437.2500	165.9865
DECT	40	0.1352	.10	0.934	2.498	0.012	2.790	3.808	0.000	766.4500	147.2607
MOVT	40	0.1885	.01	0.988	2.642	0.008	-0.100	-0.136	0.892	670.8000	148.8460

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 516

G=2 S=1 C=3 H=4 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1986	.01	0.966	2.584	0.010	0.474	0.646	0.518	1383.4750	177.7064
DECT	40	0.1506	.05	-0.217	-0.579	0.562	3.022	4.125	0.000	686.6000	85.6237
MOVT	40	0.2383	.01	1.624	4.344	0.000	2.076	2.833	0.005	696.8750	168.7722

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 517

G=2 S=1 C=4 H=2 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1331	.10	0.435	1.163	0.245	-0.561	-0.765	0.444	1073.9250	117.8877
DECT	40	0.1700	.01	0.582	1.558	0.119	0.160	0.218	0.828	358.5000	52.0335
MOVT	40	0.1091	>.20	0.212	0.566	0.571	-0.626	-0.854	0.393	715.4250	121.2031

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 518

G=2 S=1 C=4 H=2 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1570	.05	-0.246	-0.659	0.510	-0.252	-0.344	0.731	1077.7000	52.6445
DECT	40	0.1691	.01	-0.992	-2.655	0.008	1.640	2.238	0.025	359.4250	54.3379
MOVT	40	0.1827	.01	0.506	1.354	0.176	-0.699	-0.955	0.340	718.2750	53.9658

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 519

G=2 S=1 C=4 H=2 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1031	>.20	0.071	0.191	0.849	-0.945	-1.290	0.197	1281.0250	161.9335
DECT	40	0.1548	.05	0.078	0.207	0.836	-0.576	-0.787	0.431	360.9000	53.5297
MOVT	40	0.2150	.01	0.551	1.475	0.140	-1.125	-1.536	0.125	920.1250	156.3847

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 520

G=2 S=1 C=4 H=2 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.0957	>.20	0.016	0.042	0.967	-0.798	-1.089	0.276	1240.6750	81.8781
DECT	40	0.1568	.01	0.533	1.426	0.154	-0.401	-0.548	0.584	374.3750	72.0049
MOVT	40	0.1396	.10	-0.225	-0.603	0.547	-1.127	-1.539	0.124	866.3000	108.0634

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 521

G=2 S=1 C=4 H=3 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1265	.15	0.609	1.627	0.104	-0.210	-0.287	0.774	1226.9000	107.3916
DECT	40	0.1897	.01	1.721	4.604	0.000	3.424	4.673	0.000	528.9250	75.3543
MOVT	40	0.2229	.01	2.174	5.817	0.000	6.452	8.807	0.000	697.9750	92.6397

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 522

G=2 S=1 C=4 H=3 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1370	.10	0.056	0.151	0.880	-1.171	-1.598	0.110	1254.0250	86.7597
DECT	40	0.2107	.01	1.197	3.202	0.001	0.244	0.333	0.739	534.3250	77.9916
MOVT	40	0.0950	>.20	0.162	0.433	0.665	-0.306	-0.418	0.676	719.7000	53.0023

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 523

G=2 S=1 C=4 H=3 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1711	.01	0.394	1.054	0.292	-1.171	-1.598	0.110	1476.2250	169.8349
DECT	40	0.1609	.01	-0.690	-1.845	0.065	1.019	1.391	0.164	596.3000	77.2874
MOVT	40	0.2052	.01	0.956	2.557	0.011	0.182	0.248	0.804	879.9250	171.2397

STATISTICAL ANALYSIS SYSTEM 10:39 TUESDAY, APRIL 11, 1978 524

G=2 S=1 C=4 H=3 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1600	.05	1.033	2.778	0.005	0.544	0.742	0.458	1481.0500	194.0486
DECT	40	0.1494	.05	0.245	0.657	0.511	-1.361	-1.858	0.063	498.4000	54.3232
MOVT	40	0.1666	.01	1.214	3.247	0.001	1.214	1.656	0.098	982.6500	175.6525

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   525

G=2 S=1 C=4 H=4 D=7

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1645	.01	0.395	1.056	0.291	-0.779	-1.063	0.288	1597.6750	204.2137
DECT	40	0.2226	.01	0.617	1.650	0.099	-1.047	-1.430	0.153	822.5750	192.4220
MOVT	40	0.2568	.01	0.742	1.984	0.047	-0.583	-0.796	0.426	775.1000	114.1508

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   526

G=2 S=1 C=4 H=4 D=10

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1967	.01	0.994	2.659	0.008	0.187	0.255	0.799	1698.1000	245.6712
DECT	40	0.1840	.01	0.784	2.099	0.036	-0.132	-0.180	0.857	793.1000	125.4200
MOVT	40	0.2108	.01	1.435	3.840	0.000	1.986	2.711	0.007	905.0000	183.0659

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   527

G=2 S=1 C=4 H=4 D=13

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.1855	.01	1.283	3.448	0.001	1.203	1.642	0.101	1575.1500	142.5535
DECT	40	0.1743	.01	-1.164	-3.114	0.002	1.814	2.476	0.013	725.2250	95.4948
MOVT	40	0.2146	.01	0.658	1.761	0.078	-0.349	-0.476	0.634	849.9250	118.0238

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978   528

G=2 S=1 C=4 H=4 D=16

VARIABLE	N	D-MAX	PROB	SKEWNESS G1	G1/SERG1	P-LEVEL G1	KURTOSIS G2	G2/SERG2	P-LEVEL G2	MEAN	ST DEV
PERT	40	0.2172	.01	1.845	4.935	0.000	3.713	5.068	0.000	1473.3250	158.4502
DECT	40	0.2206	.01	1.105	2.957	0.003	0.873	1.192	0.233	617.3500	51.9800
MOVT	40	0.1753	.01	1.789	4.782	0.000	3.312	4.521	0.000	655.9750	157.1093

APPENDIX C

C.1 Samples of part of the results of means of performance, decision and movement time.

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978 961

G=1 S=1 C=1 H=2 D=7

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	943.23500000	117.55947486	668.00000000	1265.00000000	18.58778505	37729.000000	13820.230128	12.464
DECT	40	270.40000000	37.52660595	201.00000000	348.00000000	5.93347738	10816.000000	1408.246154	13.878
MOVT	40	672.82500000	116.55083352	462.00000000	965.00000000	18.42830486	26913.000000	13584.096795	17.323
G=1 S=1 C=1 H=2 D=10									
PERT	40	1066.75000000	125.05849313	857.00000000	1356.00000000	19.77348490	42670.000000	15639.628205	11.723
DECT	40	266.35000000	38.10481496	201.00000000	372.00000000	6.02490025	10654.000000	1451.976923	14.306
MOVT	40	800.40000000	113.50224216	618.00000000	1115.00000000	17.94628024	32016.000000	12882.758974	14.181
G=1 S=1 C=1 H=2 D=13									
PERT	40	1134.60000000	152.42111032	843.00000000	1472.00000000	24.09989361	45384.000000	23232.194872	13.434
DECT	40	259.47500000	43.55538257	200.00000000	376.00000000	6.88718501	10379.000000	1897.332692	16.787
MOVT	40	875.12500000	136.13916276	635.00000000	1108.00000000	21.52533354	35005.000000	18533.599359	15.556
G=1 S=1 C=1 H=2 D=16									
PERT	40	1251.40000000	99.95686249	1091.00000000	1455.00000000	15.80456766	50056.000000	9991.374359	7.988
DECT	40	269.92500000	36.75657102	203.00000000	333.00000000	5.81172417	10797.000000	1351.045513	13.617
MOVT	40	981.47500000	100.43960814	789.00000000	1238.00000000	15.87947343	39259.000000	10086.307051	10.233
G=1 S=1 C=1 H=3 D=7									
PERT	40	1059.57500000	156.23739923	787.00000000	1441.00000000	24.70328763	42383.000000	24410.096795	14.745
DECT	40	345.67500000	43.67736461	230.00000000	462.00000000	6.90595772	13827.000000	1907.712179	12.635
MOVT	40	713.90000000	147.81655297	389.00000000	1052.00000000	23.37184916	28556.000000	21849.733333	20.705
G=1 S=1 C=1 H=3 D=10									
PERT	40	1152.90000000	114.64701680	915.00000000	1405.00000000	18.12728500	46116.000000	13143.938462	9.944
DECT	40	344.60000000	35.45079653	234.00000000	430.00000000	5.60526309	13784.000000	1256.758974	10.288
MOVT	40	808.30000000	112.92979439	615.00000000	1045.00000000	17.85576830	32332.000000	12753.138462	13.971
G=1 S=1 C=1 H=3 D=13									
PERT	40	1215.42500000	134.14475295	963.00000000	1492.00000000	21.21014777	48617.000000	17994.814744	11.037
DECT	40	328.65000000	41.09061282	223.00000000	412.00000000	6.49695635	13146.000000	1688.438462	12.503
MOVT	40	886.77500000	129.56544480	643.00000000	1236.00000000	20.48605558	35471.000000	16787.204487	14.611
G=1 S=1 C=1 H=3 D=16									
PERT	40	1276.25000000	115.58008656	988.00000000	1504.00000000	18.27481629	51050.000000	13358.756410	9.056
DECT	40	354.30000000	47.85940949	233.00000000	500.00000000	7.56723707	14172.000000	2290.523077	13.508
MOVT	40	921.95000000	127.57098577	583.00000000	1241.00000000	20.17074392	36878.000000	16274.356410	13.837
G=1 S=1 C=1 H=4 D=7									
PERT	40	1187.15000000	217.87217495	831.00000000	1574.00000000	34.44861558	47486.000000	47468.284615	18.353
DECT	40	367.47500000	135.48298328	203.00000000	682.00000000	21.42174152	14699.000000	18355.640385	36.869
MOVT	40	819.67500000	172.08366890	574.00000000	1287.00000000	27.20881709	32787.000000	29612.789103	20.994
G=1 S=1 C=1 H=4 D=10									
PERT	40	1177.00000000	151.15062957	958.00000000	1576.00000000	23.89901236	47080.000000	22846.512821	12.842
DECT	40	394.40000000	109.52971731	212.00000000	637.00000000	17.31816891	15776.000000	11996.758974	27.771
MOVT	40	782.60000000	137.16671496	575.00000000	1235.00000000	21.68796192	31304.000000	18814.707692	17.527
G=1 S=1 C=1 H=4 D=13									
PERT	40	1286.30000000	222.33795021	982.00000000	2330.00000000	35.15471665	51452.000000	49434.164103	17.285
DECT	40	384.07500000	94.54489844	235.00000000	705.00000000	14.94886101	15363.000000	8938.737821	24.616
MOVT	40	902.22500000	195.53155526	564.00000000	1621.00000000	30.91625345	36089.000000	38232.589103	21.672
G=1 S=1 C=1 H=4 D=16									
PERT	40	1270.55000000	105.46452800	1082.00000000	1662.00000000	16.67540604	50822.000000	11122.766667	8.301
DECT	40	367.62500000	99.92065763	217.00000000	602.00000000	15.79884317	14705.000000	9984.137821	27.180
MOVT	40	902.92500000	143.23002613	587.00000000	1224.00000000	22.64665559	36117.000000	20514.840385	15.863

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VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
G=1 S=1 C=2 H=2 D=7									
PERT	40	996.32500000	102.11491453	718.00000000	1106.00000000	16.14578565	39853.000000	10427.455769	11.267
DECT	40	268.82500000	36.08599949	209.00000000	361.00000000	5.70569750	10753.000000	1302.199359	13.424
MOVT	40	637.50000000	103.18367989	481.00000000	876.00000000	16.31477229	25500.000000	10646.871795	16.186
G=1 S=1 C=2 H=2 D=10									
PERT	40	1015.55000000	87.35774186	902.00000000	1292.00000000	13.81247810	40622.000000	7631.3820513	8.602
DECT	40	249.82500000	28.32765126	200.00000000	312.00000000	4.47899478	9993.000000	802.4557692	11.339
MOVT	40	765.72500000	92.69829404	602.00000000	1055.00000000	14.65688722	30629.000000	8592.9737179	12.106
G=1 S=1 C=2 H=2 D=13									
PERT	40	1088.32500000	138.61372032	922.00000000	1461.00000000	21.91675356	43533.000000	19213.763462	12.736
DECT	40	260.42500000	36.87462299	205.00000000	364.00000000	5.83038983	10417.000000	1359.737821	14.159
MOVT	40	827.90000000	144.23570453	620.00000000	1195.00000000	22.80566731	33116.000000	20803.938462	17.422
G=1 S=1 C=2 H=2 D=16									
PERT	40	1188.97500000	65.30539205	1049.00000000	1338.00000000	10.32568512	47559.000000	4264.7942308	5.493
DECT	40	251.07500000	36.03017788	201.00000000	328.00000000	5.69687133	10043.000000	1298.1737179	14.350
MOVT	40	937.90000000	63.91091556	794.00000000	1091.00000000	10.10520303	37516.000000	4084.6051282	6.814
G=1 S=1 C=2 H=3 D=7									
PERT	40	961.42500000	111.66981722	814.00000000	1236.00000000	17.65654841	38457.000000	12470.148077	11.603
DECT	40	340.47500000	33.23934410	271.00000000	440.00000000	5.25417874	13619.000000	1104.255769	9.760
MOVT	40	621.95000000	111.35481522	451.00000000	890.00000000	17.60674223	24878.000000	12399.894872	17.904
G=1 S=1 C=2 H=3 D=10									
PERT	40	1042.07500000	89.92572077	913.00000000	1375.00000000	14.21850489	41683.000000	8086.6352564	8.629
DECT	40	336.70000000	38.45690228	235.00000000	425.00000000	6.08057015	13468.000000	1478.9333333	11.422
MOVT	40	705.37500000	98.52910217	549.00000000	1025.00000000	15.57881893	28215.000000	9707.9839744	13.968
G=1 S=1 C=2 H=3 D=13									
PERT	40	1169.25000000	96.25307188	957.00000000	1381.00000000	15.21894695	46770.000000	9264.653846	8.232
DECT	40	313.02500000	36.61265344	219.00000000	377.00000000	5.78896912	12521.000000	1340.486538	11.513
MOVT	40	851.22500000	108.04070636	618.00000000	1104.00000000	17.08273561	34049.000000	11672.794231	12.692
G=1 S=1 C=2 H=3 D=16									
PERT	40	1262.20000000	127.65301527	1037.00000000	1617.00000000	20.18371392	50488.000000	16295.292308	10.114
DECT	40	347.02500000	33.97924517	295.00000000	457.00000000	5.37259040	13881.000000	1154.589103	9.792
MOVT	40	915.17500000	128.35045923	664.00000000	1254.00000000	20.29398549	36607.000000	16473.840385	14.025
G=1 S=1 C=2 H=4 D=7									
PERT	40	1186.62500000	197.98390986	881.00000000	1762.00000000	31.30400334	47465.000000	39197.625000	16.685
DECT	40	376.30000000	77.55738493	240.00000000	572.00000000	12.26299415	15052.000000	6015.241026	20.611
MOVT	40	810.32500000	218.47600203	577.00000000	1424.00000000	34.54408902	32413.000000	47731.763462	26.962
G=1 S=1 C=2 H=4 D=10									
PERT	40	1301.40000000	194.70882929	985.00000000	1814.00000000	30.78616506	52056.000000	37911.528205	14.950
DECT	40	328.82500000	65.92182141	226.00000000	453.00000000	10.42315516	13153.000000	4345.686538	20.048
MOVT	40	973.57500000	203.94454946	595.00000000	1504.00000000	32.24646448	38943.000000	41593.378846	20.948
G=1 S=1 C=2 H=4 D=13									
PERT	40	1317.37500000	88.65279075	1145.00000000	1474.00000000	14.01723698	52695.000000	7859.317308	6.730
DECT	40	366.77500000	95.14536449	240.00000000	614.00000000	15.04380303	14671.000000	9052.640385	25.941
MOVT	40	950.60000000	153.97615533	682.00000000	1195.00000000	24.34576781	38024.000000	23708.656410	16.198
G=1 S=1 C=2 H=4 D=16									
PERT	40	1322.45000000	85.34934245	1184.00000000	1566.00000000	13.49491595	52898.000000	7284.510256	6.454
DECT	40	374.82500000	112.69083814	213.00000000	634.00000000	17.81798600	14993.000000	12699.225000	30.065
MOVT	40	947.62500000	133.28890686	623.00000000	1171.00000000	21.07482663	37905.000000	17765.932692	14.066

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G=1 S=1 C=3 H=2 D=7

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	855.37500000	74.85578911	717.00000000	1005.00000000	11.84048290	34215.000000	5607.8814103	8.755
DECT	40	250.82500000	37.07641970	203.00000000	318.00000000	5.86229669	10033.000000	1374.6608974	14.782
MOVT	40	604.55000000	90.85969742	433.00000000	757.00000000	14.36617557	24182.000000	8255.4846154	15.029
G=1 S=1 C=3 H=2 D=10									
PERT	40	943.27500000	33.66557654	855.00000000	1002.00000000	5.32362749	37531.000000	1133.6403846	3.551
DECT	40	264.92500000	37.79050722	208.00000000	330.00000000	5.97520384	10597.000000	1428.1224359	14.265
MOVT	40	683.35000000	56.46444309	540.00000000	754.00000000	8.92781235	27334.000000	3188.2333333	8.263
G=1 S=1 C=3 H=2 D=13									
PERT	40	1057.62500000	68.46773056	924.00000000	1154.00000000	10.82565874	42305.000000	4687.8301282	6.474
DECT	40	263.50000000	36.54712448	206.00000000	346.00000000	5.77860776	10540.000000	1335.6923077	13.870
MOVT	40	794.12500000	68.26689234	652.00000000	936.00000000	10.79394343	31765.000000	4660.3685897	8.596
G=1 S=1 C=3 H=2 D=16									
PERT	40	1184.17500000	108.50260247	1004.00000000	1386.00000000	17.15576779	47367.000000	11772.814744	9.163
DECT	40	278.47500000	48.35604462	201.00000000	393.00000000	7.64576198	11139.000000	2338.307051	17.365
MOVT	40	905.70000000	93.42959407	713.00000000	1115.00000000	14.77251433	36228.000000	8729.087179	10.316
G=1 S=1 C=3 H=3 D=7									
PERT	40	1082.55000000	95.18348004	814.00000000	1248.00000000	15.04982563	43302.000000	9059.894872	8.793
DECT	40	331.65000000	58.38973830	227.00000000	473.00000000	9.23222825	13266.000000	3409.361538	17.606
MOVT	40	750.90000000	122.96461863	341.00000000	925.00000000	19.44241332	30036.000000	15120.297436	16.376
G=1 S=1 C=3 H=3 D=10									
PERT	40	1381.62500000	209.32243408	1114.00000000	1814.00000000	33.09678285	55265.000000	43815.881410	15.150
DECT	40	325.30000000	61.03349228	229.00000000	457.00000000	9.65024246	13012.000000	3725.087179	18.762
MOVT	40	1056.32500000	203.69552284	739.00000000	1461.00000000	32.20709007	42253.000000	41491.866026	19.283
G=1 S=1 C=3 H=3 D=13									
PERT	40	1425.67500000	122.36167229	1225.00000000	1774.00000000	19.34707514	57027.000000	14972.378846	8.583
DECT	40	407.80000000	222.78035636	227.00000000	1318.00000000	35.22466720	16312.000000	49631.087179	54.630
MOVT	40	1017.87500000	183.88139816	323.00000000	1204.00000000	29.07420188	40715.000000	33812.368590	18.065
G=1 S=1 C=3 H=3 D=16									
PERT	40	1428.70000000	87.05972015	1301.00000000	1614.00000000	13.76535041	57148.000000	7579.3948718	6.094
DECT	40	359.80000000	94.32654682	215.00000000	667.00000000	14.91433659	14392.000000	8897.4974359	26.216
MOVT	40	1068.90000000	98.37025817	902.00000000	1254.00000000	15.55370349	42756.000000	9676.7076923	9.203
G=1 S=1 C=3 H=4 D=7									
PERT	40	1052.90000000	125.17368446	842.00000000	1432.00000000	19.79169730	42116.000000	15668.451282	11.888
DECT	40	455.35000000	47.79573962	348.00000000	586.00000000	7.55717947	18214.000000	2284.438462	10.496
MOVT	40	597.55000000	114.62155120	432.00000000	915.00000000	18.12325854	23902.000000	13138.100000	19.182
G=1 S=1 C=3 H=4 D=10									
PERT	40	1090.52500000	92.45178577	875.00000000	1262.00000000	14.61791084	43621.000000	8547.3326923	8.478
DECT	40	429.47500000	64.85446726	259.00000000	593.00000000	10.25435165	17179.000000	4206.1019231	15.101
MOVT	40	661.05000000	87.37333689	437.00000000	831.00000000	13.81493757	26442.000000	7634.1000000	13.217
G=1 S=1 C=3 H=4 D=13									
PERT	40	1222.95000000	102.69195909	1066.00000000	1474.00000000	16.23702441	48918.000000	10545.638462	8.397
DECT	40	459.42500000	41.08832731	387.00000000	568.00000000	6.49663498	18377.000000	1688.250641	8.943
MOVT	40	763.52500000	92.16345221	582.00000000	968.00000000	14.57232130	30541.000000	8494.101923	12.071
G=1 S=1 C=3 H=4 D=16									
PERT	40	1279.97500000	60.45659070	1204.00000000	1460.00000000	9.55902631	51199.000000	3654.9953590	4.723
DECT	40	440.17500000	60.50354472	289.00000000	541.00000000	9.57593722	17607.000000	3667.9429487	13.759
MOVT	40	839.80000000	78.84200364	768.00000000	1045.00000000	12.46601534	33592.000000	6216.0615385	9.388

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G=1 S=1 C=4 H=2 D=7

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1179.00000000	115.47116412	980.00000000	1443.00000000	18.25759413	47160.000000	13333.589744	9.794
DFCT	40	264.90000000	39.77339165	202.00000000	355.00000000	6.28967408	10596.000000	1582.400000	15.017
MOVT	40	914.10000000	112.69445872	652.00000000	1164.00000000	17.81855846	36564.000000	12700.041026	12.328
G=1 S=1 C=4 H=2 D=10									
PERT	40	1190.17500000	109.73368403	1026.00000000	1382.00000000	17.35041888	47607.000000	12041.481410	9.220
DFCT	40	276.82500000	40.16561069	200.00000000	363.00000000	6.35074067	11073.000000	1613.276282	14.509
MOVT	40	913.35000000	110.94756211	766.00000000	1114.00000000	17.54234986	36534.000000	12309.361538	12.147
G=1 S=1 C=4 H=2 D=13									
PERT	40	1289.15000000	140.27693396	1130.00000000	1686.00000000	22.17973058	51566.000000	19677.617949	10.890
DFCT	40	268.55000000	46.51106844	202.00000000	353.00000000	7.35404563	10742.000000	2163.279487	17.319
MOVT	40	1019.60000000	150.55143086	807.00000000	1400.00000000	23.80427133	40784.000000	22665.733333	14.766
G=1 S=1 C=4 H=2 D=16									
PERT	40	1381.37500000	101.06298810	1227.00000000	1563.00000000	15.97946148	55255.000000	10213.727564	7.316
DFCT	40	260.90000000	40.27711700	203.00000000	350.00000000	6.36837137	10436.000000	1622.246154	15.438
MOVT	40	1120.47500000	99.91046954	907.00000000	1258.00000000	15.79723229	44819.000000	9982.101923	8.917
G=1 S=1 C=4 H=3 D=7									
PERT	40	1262.62500000	221.90558023	918.00000000	1788.00000000	35.08635295	50505.000000	49242.086538	17.575
DFCT	40	410.55000000	49.87571733	279.00000000	455.00000000	7.88604334	16422.000000	2487.587179	12.149
MOVT	40	852.07500000	210.66870181	565.00000000	1378.00000000	33.30964647	34083.000000	44381.301923	24.724
G=1 S=1 C=4 H=3 D=10									
PERT	40	1217.82500000	103.76227453	1005.00000000	1447.00000000	16.40625614	48713.000000	10766.609615	8.520
DFCT	40	404.45000000	61.04388921	279.00000000	552.00000000	9.65188636	16178.000000	3726.356410	15.093
MOVT	40	813.37500000	88.83799358	678.00000000	1035.00000000	14.04652012	32535.000000	7892.189103	10.922
G=1 S=1 C=4 H=3 D=13									
PERT	40	1338.82500000	100.68938373	1006.00000000	1610.00000000	15.92039039	53553.000000	10138.353205	7.521
DFCT	40	385.17500000	54.27890344	241.00000000	525.00000000	8.58224819	15407.000000	2946.159359	14.092
MOVT	40	953.65000000	100.54787098	765.00000000	1216.00000000	15.89801431	38146.000000	10109.874359	10.543
G=1 S=1 C=4 H=3 D=16									
PERT	40	1490.65000000	113.99067663	1266.00000000	1820.00000000	18.02350651	59626.000000	12993.874359	7.647
DFCT	40	424.67500000	55.64327199	303.00000000	539.00000000	8.79797380	16987.000000	3096.173718	13.103
MOVT	40	1065.97500000	140.76965719	866.00000000	1446.00000000	22.25751062	42639.000000	19815.871154	13.206
G=1 S=1 C=4 H=4 D=7									
PERT	40	1370.32500000	176.54329912	1104.00000000	1731.00000000	27.91473711	54813.000000	31169.301523	12.884
DFCT	40	475.12500000	68.14839947	299.00000000	627.00000000	10.77516063	19005.000000	4644.163462	14.343
MOVT	40	895.20000000	155.05238155	656.00000000	1200.00000000	24.51593412	35808.000000	24041.241026	17.320
G=1 S=1 C=4 H=4 D=10									
PERT	40	1389.85000000	157.92347222	1188.00000000	1811.00000000	24.96989341	55594.000000	24939.823077	11.363
DFCT	40	471.35000000	67.97569324	346.00000000	660.00000000	10.74790081	18854.000000	4620.694872	14.421
MOVT	40	918.50000000	144.07565676	733.00000000	1342.00000000	22.78036154	36740.000000	20757.794872	15.686
G=1 S=1 C=4 H=4 D=13									
PERT	40	1472.50000000	158.24631887	1206.00000000	2047.00000000	25.02093995	58900.000000	25041.897436	10.747
DFCT	40	471.05000000	70.82768907	299.00000000	664.00000000	11.19884094	18842.000000	5016.561538	15.036
MOVT	40	1001.45000000	133.48714526	762.00000000	1383.00000000	21.10617087	40058.000000	17818.817949	13.329
G=1 S=1 C=4 H=4 D=16									
PERT	40	1487.52500000	128.28513664	1322.00000000	1830.00000000	20.28366109	59501.000000	16457.076282	8.624
DFCT	40	417.62500000	89.28223400	331.00000000	655.00000000	14.11676070	16705.000000	7971.317308	19.093
MOVT	40	1019.90000000	135.35514533	712.00000000	1372.00000000	21.40152762	40796.000000	18321.015385	13.271

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978 965

G=1 S=2 C=1 H=2 D=7

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	695.10000000	60.90009211	585.00000000	831.00000000	9.62913581	27804.000000	3708.8102564	8.761
DECT	40	271.35000000	37.61968855	200.00000000	383.00000000	5.95135731	10854.000000	1416.7461538	13.745
MOVT	40	421.25000000	57.63356839	278.00000000	517.00000000	9.11266729	16850.000000	3321.6282051	13.682
G=1 S=2 C=1 H=2 D=10									
PERT	40	855.60000000	115.60826971	698.00000000	1205.00000000	18.27927227	34224.000000	13365.271795	13.512
DECT	40	282.15000000	27.68925553	219.00000000	342.00000000	4.37805571	11286.000000	766.694872	9.814
MOVT	40	573.45000000	101.84728387	415.00000000	919.00000000	16.10346553	22938.000000	10372.869231	17.760
G=1 S=2 C=1 H=2 D=13									
PERT	40	908.85000000	118.77592564	780.00000000	1392.00000000	18.78012281	36354.000000	14107.720513	13.069
DECT	40	296.02500000	34.33282611	216.00000000	383.00000000	5.42849645	11841.000000	1178.742949	11.598
MOVT	40	612.82500000	109.31157245	417.00000000	1063.00000000	17.28367718	24513.000000	11949.019872	17.837
G=1 S=2 C=1 H=2 D=16									
PERT	40	969.97500000	126.73523532	811.00000000	1617.00000000	20.03860017	38799.000000	16061.819872	13.066
DECT	40	290.97500000	26.62126343	244.00000000	368.00000000	4.20919133	11639.000000	708.691667	9.149
MOVT	40	679.00000000	114.98628681	517.00000000	1245.00000000	18.18092830	27160.000000	13221.846154	16.935
G=1 S=2 C=1 H=3 D=7									
PERT	40	891.37500000	125.77751776	690.00000000	1204.00000000	19.88717173	35655.000000	15819.983974	14.111
DECT	40	381.25000000	32.21542074	313.00000000	500.00000000	5.09370527	15250.000000	1037.833333	8.450
MOVT	40	510.12500000	129.25530044	309.00000000	827.00000000	20.43705745	20405.000000	16706.932692	25.338
G=1 S=2 C=1 H=3 D=10									
PERT	40	905.17500000	115.41827778	736.00000000	1200.00000000	18.24923207	36207.000000	13321.378846	12.751
DECT	40	371.87500000	26.50997635	313.00000000	444.00000000	4.19159530	14875.000000	702.778846	7.129
MOVT	40	533.30000000	113.04984152	376.00000000	847.00000000	17.87474942	21332.000000	12780.266667	21.198
G=1 S=2 C=1 H=3 D=13									
PERT	40	890.52500000	54.09250742	757.00000000	1066.00000000	8.55277639	35621.000000	2925.9993590	6.074
DECT	40	375.72500000	19.14182895	317.00000000	409.00000000	3.02658890	15029.000000	366.4096154	5.095
MOVT	40	514.80000000	53.31195984	429.00000000	680.00000000	8.42935956	20592.000000	2842.1641026	10.356
G=1 S=2 C=1 H=3 D=16									
PERT	40	992.15000000	90.14448516	856.00000000	1175.00000000	14.25309458	39686.000000	8126.0282051	9.086
DECT	40	377.15000000	32.82709169	306.00000000	454.00000000	5.19041893	15086.000000	1077.6179487	8.704
MOVT	40	615.00000000	96.74682795	402.00000000	806.00000000	15.29701664	24600.000000	9359.9487179	15.731
G=1 S=2 C=1 H=4 D=7									
PERT	40	987.00000000	165.58443504	777.00000000	1467.00000000	26.18119799	39480.000000	27418.205128	16.777
DECT	40	510.40000000	65.30276627	391.00000000	672.00000000	10.32527395	20416.000000	4264.451282	12.794
MOVT	40	476.60000000	155.74894328	167.00000000	943.00000000	24.62607020	19064.000000	24257.733333	32.679
G=1 S=2 C=1 H=4 D=10									
PERT	40	1120.02500000	173.73815353	755.00000000	1712.00000000	27.47041503	44801.000000	30184.948077	15.512
DECT	40	492.07500000	42.58890400	374.00000000	595.00000000	6.73389698	19683.000000	1813.814744	8.655
MOVT	40	627.95000000	171.79444336	358.00000000	1212.00000000	27.16308652	25118.000000	29513.330769	27.358
G=1 S=2 C=1 H=4 D=13									
PERT	40	1092.75000000	123.41585943	887.00000000	1382.00000000	19.51376076	43710.000000	15231.474359	11.294
DECT	40	490.10000000	53.61151809	338.00000000	640.00000000	8.47672530	19604.000000	2874.194872	10.939
MOVT	40	602.65000000	119.15612469	422.00000000	937.00000000	18.84023756	24106.000000	14198.182051	19.772
G=1 S=2 C=1 H=4 D=16									
PERT	40	1089.92500000	91.26472835	854.00000000	1314.00000000	14.43022058	43597.000000	8329.2506410	8.373
DECT	40	498.90000000	47.83507993	420.00000000	635.00000000	7.56339023	19956.000000	2288.1948718	9.588
MOVT	40	591.02500000	85.13653815	432.00000000	775.00000000	13.46126663	23641.000000	7248.2301282	14.405

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978 966

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
G=1 S=2 C=2 H=2 D=7									
PERT	40	752.70000000	101.73021133	558.00000000	1024.00000000	16.08495673	30108.000000	10349.035897	13.515
DECT	40	280.17500000	28.94104308	200.00000000	333.00000000	4.57598070	11207.000000	837.583974	10.330
MOVT	40	472.52500000	98.06773889	342.00000000	746.00000000	15.50587099	18901.000000	9617.281410	20.754
G=1 S=2 C=2 H=2 D=10									
PERT	40	820.80000000	116.42631652	704.00000000	1175.00000000	18.40861699	32832.000000	13555.087179	14.184
DECT	40	289.57500000	30.90920126	228.00000000	365.00000000	4.88717415	11583.000000	955.378846	10.318
MOVT	40	521.22500000	114.66237786	382.00000000	875.00000000	18.12971380	20849.000000	13147.460897	21.999
G=1 S=2 C=2 H=2 D=13									
PERT	40	945.72500000	139.17411949	677.00000000	1300.00000000	22.00536029	37829.000000	19369.435256	14.716
DECT	40	297.60000000	43.47342247	234.00000000	433.00000000	6.87375163	11904.000000	1889.938462	14.608
MOVT	40	648.12500000	134.13353230	433.00000000	966.00000000	21.20837363	25925.000000	17991.804487	20.696
G=1 S=2 C=2 H=2 D=16									
PERT	40	967.15000000	61.15157712	876.00000000	1078.00000000	9.66891331	38686.000000	3739.5153846	6.323
DECT	40	304.80000000	22.80035987	251.00000000	342.00000000	3.60505343	12192.000000	519.8564103	7.480
MOVT	40	662.35000000	62.14645647	565.00000000	790.00000000	9.82621755	26494.000000	3862.1820513	9.383
G=1 S=2 C=2 H=3 D=7									
PERT	40	901.05000000	72.12149537	761.00000000	1009.00000000	11.40467459	36042.000000	5202.6641026	8.005
DECT	40	411.25000000	23.93554379	378.00000000	502.00000000	3.78454177	16450.000000	572.9102564	5.820
MOVT	40	489.80000000	67.45414397	375.00000000	607.00000000	10.66543663	19592.000000	4550.0615385	13.772
G=1 S=2 C=2 H=3 D=10									
PERT	40	900.10000000	95.63949404	836.00000000	1194.00000000	15.12193177	36004.000000	9146.9128205	9.660
DECT	40	407.42500000	35.10781015	307.00000000	500.00000000	5.55103219	16297.000000	1232.5583333	8.617
MOVT	40	582.67500000	93.70203398	428.00000000	794.00000000	14.81559242	23307.000000	8780.0711538	16.081
G=1 S=2 C=2 H=3 D=13									
PERT	40	1029.15000000	75.56303193	902.00000000	1218.00000000	11.94756439	41166.000000	5709.7717949	7.342
DECT	40	420.35000000	34.67915209	370.00000000	534.00000000	5.48325540	16814.000000	1202.6435897	8.250
MOVT	40	608.80000000	72.53335219	485.00000000	757.00000000	11.46852596	24352.000000	5261.0871795	11.914
G=1 S=2 C=2 H=3 D=16									
PERT	40	1054.87500000	86.49386743	863.00000000	1308.00000000	13.67588124	42195.000000	7481.1891026	8.199
DECT	40	428.60000000	44.93859058	320.00000000	525.00000000	7.10541505	17144.000000	2019.4769231	10.485
MOVT	40	626.27500000	87.08409949	478.00000000	875.00000000	13.76920512	25051.000000	7583.6403846	13.905
G=1 S=2 C=2 H=4 D=7									
PERT	40	1006.20000000	91.48439688	830.00000000	1226.00000000	14.46495322	40248.000000	8369.3948718	9.092
DECT	40	496.00000000	17.37224429	447.00000000	541.00000000	2.74679300	19840.000000	301.7948718	3.502
MOVT	40	510.20000000	88.88863675	342.00000000	721.00000000	14.05452751	20408.000000	7901.1897436	17.422
G=1 S=2 C=2 H=4 D=10									
PERT	40	1100.65000000	114.02081456	955.00000000	1445.00000000	18.02827373	44026.000000	13000.746154	10.359
DECT	40	515.35000000	30.60547127	462.00000000	592.00000000	4.83914990	20614.000000	936.694872	5.939
MOVT	40	585.30000000	102.70225823	490.00000000	890.00000000	16.23865284	23412.000000	10547.753846	17.547
G=1 S=2 C=2 H=4 D=13									
PERT	40	1129.52500000	64.92875287	1000.00000000	1242.00000000	10.26613723	45181.000000	4215.7429487	5.748
DECT	40	500.57500000	30.06820239	457.00000000	572.00000000	4.75420023	20023.000000	904.0967949	6.007
MOVT	40	628.95000000	61.03086651	524.00000000	759.00000000	9.64982729	25158.000000	3724.7666667	9.704
G=1 S=2 C=2 H=4 D=16									
PERT	40	1130.35000000	64.13189534	1013.00000000	1243.00000000	10.14014300	45214.000000	4112.9000000	5.674
DECT	40	495.02500000	28.74332698	413.00000000	554.00000000	4.54471594	19801.000000	826.1788462	5.806
MOVT	40	635.32500000	55.41886539	532.00000000	746.00000000	8.76249200	25413.000000	3071.2506410	8.723

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G=1 S=2 C=3 H=2 D=7

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	929.10000000	87.65427425	782.00000000	1111.00000000	13.85935766	36804.000000	7683.2717949	9.527
DECT	40	292.10000000	35.76690922	243.00000000	385.00000000	5.65524490	11684.000000	1279.2717949	12.245
MOVT	40	628.00000000	97.46110335	420.00000000	813.00000000	15.40995349	25120.000000	9498.6666667	15.519
G=1 S=2 C=3 H=2 D=10									
PERT	40	891.60000000	106.50624154	815.00000000	1250.00000000	16.84011541	35664.000000	11343.579487	10.741
DECT	40	300.52500000	25.54130641	252.00000000	385.00000000	4.03843513	12021.000000	652.358333	8.499
MOVT	40	691.07500000	104.74128995	526.00000000	946.00000000	16.56105207	27643.000000	10970.737821	15.156
G=1 S=2 C=3 H=2 D=13									
PERT	40	1062.25000000	88.91129258	913.00000000	1335.00000000	14.05810571	42490.000000	7905.2179487	8.370
DECT	40	305.37500000	39.24850969	248.00000000	402.00000000	6.20573427	12215.000000	1540.4455128	12.853
MOVT	40	756.87500000	81.21266401	622.00000000	991.00000000	12.84084966	30275.000000	6595.4967949	10.730
G=1 S=2 C=3 H=2 D=16									
PERT	40	1097.70000000	98.60025485	900.00000000	1404.00000000	15.59006516	43908.000000	9722.010256	8.982
DECT	40	302.87500000	29.45416909	246.00000000	411.00000000	4.65711305	12115.000000	867.548077	9.725
MOVT	40	794.82500000	102.84040100	555.00000000	1075.00000000	16.26049513	31793.000000	10576.148077	12.939
G=1 S=2 C=3 H=3 D=7									
PERT	40	945.75000000	124.23917174	700.00000000	1331.00000000	19.64393787	37830.000000	15435.371795	13.137
DECT	40	344.70000000	26.81101955	301.00000000	355.00000000	4.23919441	13788.000000	718.830769	7.778
MOVT	40	601.05000000	118.42945536	398.00000000	982.00000000	18.72534105	24042.000000	14025.535897	19.704
G=1 S=2 C=3 H=3 D=10									
PERT	40	978.22500000	106.01584001	894.00000000	1238.00000000	16.76257612	39129.000000	11239.358333	10.838
DECT	40	343.05000000	41.65951254	242.00000000	412.00000000	6.58679234	13722.000000	1735.433333	12.144
MOVT	40	635.17500000	95.13118810	485.00000000	888.00000000	15.04156155	25407.000000	9049.942949	14.977
G=1 S=2 C=3 H=3 D=13									
PERT	40	1064.87500000	105.51222739	859.00000000	1326.00000000	16.68294798	42595.000000	11132.830128	9.908
DECT	40	347.47500000	37.21867283	281.00000000	441.00000000	5.88478999	13899.000000	1385.230128	10.711
MOVT	40	717.40000000	96.60116260	559.00000000	945.00000000	15.27398492	28696.000000	9331.784615	13.465
G=1 S=2 C=3 H=3 D=16									
PERT	40	1134.75000000	134.85771229	926.00000000	1467.00000000	21.32287654	45390.000000	18186.602564	11.884
DECT	40	351.17500000	37.87962547	283.00000000	447.00000000	5.98929467	14047.000000	1434.866026	10.787
MOVT	40	783.57500000	119.08387208	614.00000000	1091.00000000	18.82881342	31343.000000	14180.968590	15.198
G=1 S=2 C=3 H=4 D=7									
PERT	40	1081.92500000	113.28620155	951.00000000	1428.00000000	17.91212122	43277.000000	12833.763462	10.471
DECT	40	486.05000000	69.16385228	299.00000000	556.00000000	10.93576525	19442.000000	4783.638462	14.230
MOVT	40	595.87500000	112.33904440	413.00000000	875.00000000	17.76236252	23835.000000	12620.060897	18.853
G=1 S=2 C=3 H=4 D=10									
PERT	40	1218.55000000	99.32256438	1106.00000000	1573.00000000	15.70427632	48742.000000	9864.9717949	8.151
DECT	40	522.15000000	43.98749822	446.00000000	641.00000000	6.95503415	20886.000000	1934.9000000	8.424
MOVT	40	696.40000000	81.41089198	576.00000000	997.00000000	12.87219225	27856.000000	6627.7333333	11.690
G=1 S=2 C=3 H=4 D=13									
PERT	40	1260.60000000	61.45575853	1111.00000000	1404.00000000	9.71700861	50424.000000	3776.8102564	4.875
DECT	40	516.37500000	62.77296901	287.00000000	667.00000000	9.92527772	20655.000000	3940.4455128	12.156
MOVT	40	744.22500000	53.43987155	653.00000000	865.00000000	8.44958560	29769.000000	2855.8198718	7.181
G=1 S=2 C=3 H=4 D=16									
PERT	40	1339.77500000	84.07350336	1170.00000000	1530.00000000	13.29635035	53591.000000	7071.7173077	6.277
DECT	40	508.42500000	51.20240755	398.00000000	643.00000000	8.09581148	20337.000000	2621.6865385	10.071
MOVT	40	831.35000000	72.78649847	689.00000000	994.00000000	11.50855590	33254.000000	5297.8743590	8.755

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
G=1 S=2 C=4 H=2 D=7									
PERT	40	936.65000000	150.55950374	749.00000000	1351.00000000	23.80561101	37466.000000	22668.284615	16.074
DECT	40	294.35000000	38.48446240	221.00000000	396.00000000	6.08492779	11774.000000	1481.053846	13.074
MOVT	40	642.30000000	139.09380712	464.00000000	955.00000000	21.99266195	25692.000000	19347.087179	21.656
G=1 S=2 C=4 H=2 D=10									
PERT	40	1012.45000000	112.66634940	780.00000000	1268.00000000	17.81406640	40498.000000	12693.638462	11.128
DECT	40	309.90000000	51.94069597	212.00000000	422.00000000	8.21254513	12396.000000	2697.835897	16.815
MOVT	40	703.55000000	125.62784886	504.00000000	1004.00000000	19.86350700	28142.000000	15782.356410	17.856
G=1 S=2 C=4 H=2 D=13									
PERT	40	1124.12500000	103.89570399	869.00000000	1341.00000000	16.42735319	44965.000000	10794.317308	9.242
DECT	40	315.67500000	42.44295568	220.00000000	407.00000000	6.71082053	12627.000000	1801.404487	13.445
MOVT	40	808.45000000	110.69827793	608.00000000	1121.00000000	17.50135243	32338.000000	12251.894872	13.691
G=1 S=2 C=4 H=2 D=16									
PERT	40	1192.80000000	134.91957718	900.00000000	1538.00000000	21.33265624	47712.000000	18203.292308	11.311
DECT	40	318.17500000	47.86352795	229.00000000	413.00000000	7.56788826	12727.000000	2290.917308	15.043
MOVT	40	874.62500000	134.34240362	635.00000000	1262.00000000	21.24139509	34985.000000	18047.881410	15.360
G=1 S=2 C=4 H=3 D=7									
PERT	40	982.07500000	80.70185315	821.00000000	1236.00000000	12.76008337	39283.000000	6512.7891026	8.217
DECT	40	432.02500000	34.37984495	357.00000000	500.00000000	5.43593073	17281.000000	1181.9737179	7.958
MOVT	40	550.05000000	81.13361882	432.00000000	823.00000000	12.82835151	22002.000000	6582.6641026	14.750
G=1 S=2 C=4 H=3 D=10									
PERT	40	1132.05000000	85.82180406	939.00000000	1321.00000000	13.56961869	45282.000000	7365.3820513	7.581
DECT	40	420.25000000	33.00407900	313.00000000	483.00000000	5.21840309	16810.000000	1089.2692308	7.853
MOVT	40	711.80000000	82.97920654	520.00000000	885.00000000	13.12016455	28472.000000	6885.5487179	11.658
G=1 S=2 C=4 H=3 D=13									
PERT	40	1167.05000000	85.16197237	996.00000000	1355.00000000	13.46525014	46682.000000	7252.5615385	7.297
DECT	40	429.30000000	33.49800015	345.00000000	505.00000000	5.29491774	17172.000000	1121.4461538	7.801
MOVT	40	737.75000000	76.08118134	564.00000000	857.00000000	12.02949101	29510.000000	5788.3461538	10.313
G=1 S=2 C=4 H=3 D=16									
PERT	40	1305.07500000	126.61635775	1085.00000000	1552.00000000	20.01981030	52203.000000	16031.712179	9.702
DECT	40	428.85000000	37.74513044	322.00000000	515.00000000	5.96802914	17154.000000	1424.694872	8.801
MOVT	40	876.22500000	123.10480394	637.00000000	1129.00000000	19.46457552	35049.000000	15154.794231	14.049
G=1 S=2 C=4 H=4 D=7									
PERT	40	1059.82500000	51.42826096	992.00000000	1184.00000000	8.13152204	42393.000000	2644.8660256	4.853
DECT	40	512.55000000	28.72678550	436.00000000	566.00000000	4.54210360	20502.000000	825.2282051	5.605
MOVT	40	547.27500000	64.42685676	441.00000000	716.00000000	10.18678049	21891.000000	4150.8198718	11.772
G=1 S=2 C=4 H=4 D=10									
PERT	40	1180.47500000	62.36081425	1056.00000000	1287.00000000	9.86011049	47219.000000	3888.8711538	5.283
DECT	40	491.32500000	36.70002271	412.00000000	566.00000000	5.80278310	19653.000000	1346.8916667	7.470
MOVT	40	689.15000000	72.01087881	556.00000000	819.00000000	11.38591567	27566.000000	5185.5666667	10.449
G=1 S=2 C=4 H=4 D=13									
PERT	40	1239.42500000	56.31309432	1100.00000000	1335.00000000	8.90483069	49577.000000	3171.8403846	4.544
DECT	40	500.40000000	43.45090468	414.00000000	568.00000000	6.87113994	20016.000000	1888.5025641	8.684
MOVT	40	739.02500000	40.37864852	641.00000000	827.00000000	6.38442491	29561.000000	1630.4352564	5.464
G=1 S=2 C=4 H=4 D=16									
PERT	40	1328.87500000	78.34348679	1164.00000000	1523.00000000	12.38719291	53155.000000	6137.7019231	5.895
DECT	40	493.75000000	48.66091466	383.00000000	600.00000000	7.69396617	19750.000000	2367.8846154	9.855
MOVT	40	835.12500000	67.68912057	712.00000000	1025.00000000	10.73421247	33405.000000	4608.9326923	8.129

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978 1001

G=2 S=1 C=1 H=2 D=7

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	949.57500000	74.01381374	845.00000000	1112.00000000	11.70261244	37983.000000	5478.0455128	7.794
DECT	40	506.77500000	40.29346674	428.00000000	578.00000000	6.37095649	20271.000000	1623.5634615	7.951
MOVT	40	442.80000000	72.35531983	356.00000000	612.00000000	11.44038057	17712.000000	5235.2923077	16.340
G=2 S=1 C=1 H=2 D=10									
PERT	40	1031.22500000	72.59599745	932.00000000	1300.00000000	11.47843505	41249.000000	5270.1788462	6.992
DECT	40	481.42500000	32.76324355	422.00000000	560.00000000	5.18032366	19257.000000	1073.4301282	6.805
MOVT	40	556.80000000	58.47208407	469.00000000	772.00000000	9.24524826	22272.000000	3418.9846154	10.501
G=2 S=1 C=1 H=2 D=13									
PERT	40	1357.37500000	428.61073652	943.00000000	2406.00000000	67.76930785	54295.000000	183707.16346	31.576
DECT	40	664.92500000	466.53866674	418.00000000	1868.00000000	73.76624017	26597.000000	217658.32756	70.164
MOVT	40	692.45000000	164.16251329	509.00000000	1076.00000000	25.95637242	27698.000000	26949.33077	23.707
G=2 S=1 C=1 H=2 D=16									
PERT	40	1455.05000000	338.83245614	1054.00000000	2106.00000000	53.57411533	58202.000000	114807.43333	23.287
DECT	40	554.70000000	185.36716164	420.00000000	1023.00000000	29.30912171	22188.000000	34360.98462	33.418
MOVT	40	900.35000000	220.11110931	611.00000000	1343.00000000	34.80262203	36014.000000	48448.90000	24.447
G=2 S=1 C=1 H=3 D=7									
PERT	40	1100.05000000	167.31621375	776.00000000	1727.00000000	26.45501625	44002.000000	27994.715385	15.210
DECT	40	584.65000000	157.18314485	206.00000000	1002.00000000	24.85283738	23386.000000	24706.541026	26.885
MOVT	40	515.40000000	87.63028396	350.00000000	725.00000000	13.85556447	20616.000000	7679.066667	17.002
G=2 S=1 C=1 H=3 D=10									
PERT	40	1289.85000000	164.06955196	1109.00000000	2120.00000000	25.94151583	51594.000000	26918.489744	12.720
DECT	40	623.90000000	81.93025204	499.00000000	825.00000000	12.95573231	24956.000000	6714.041026	13.133
MOVT	40	665.95000000	148.24061349	418.00000000	1295.00000000	23.43889502	26638.000000	21975.279487	22.260
G=2 S=1 C=1 H=3 D=13									
PERT	40	1339.20000000	59.35516740	1114.00000000	1455.00000000	9.38487599	53568.000000	3523.0358974	4.432
DECT	40	601.05000000	46.57607507	485.00000000	700.00000000	7.36432409	24042.000000	2169.3307692	7.749
MOVT	40	738.15000000	59.10293364	629.00000000	850.00000000	9.34499386	29526.000000	3493.1564103	8.007
G=2 S=1 C=1 H=3 D=16									
PERT	40	1441.07500000	168.26175998	1092.00000000	1845.00000000	26.60452023	57643.000000	28312.019872	11.676
DECT	40	611.70000000	63.65580522	499.00000000	736.00000000	10.06486654	24468.000000	4052.061538	10.406
MOVT	40	829.37500000	148.93582984	568.00000000	1159.00000000	23.54882238	33175.000000	22181.881410	17.958
G=2 S=1 C=1 H=4 D=7									
PERT	40	1151.32500000	216.12406070	896.00000000	1659.00000000	34.17221445	46053.000000	46709.609615	18.772
DECT	40	589.10000000	182.87010943	385.00000000	1030.00000000	28.91430309	23564.000000	33441.476923	31.042
MOVT	40	562.22500000	113.09072544	407.00000000	815.00000000	17.88121373	22489.000000	12789.512179	20.115
G=2 S=1 C=1 H=4 D=10									
PERT	40	1428.15000000	170.74505662	1115.00000000	1865.00000000	26.99716391	57126.000000	29153.674359	11.956
DECT	40	805.15000000	92.68157598	608.00000000	1045.00000000	14.65424372	32206.000000	8589.874359	11.511
MOVT	40	623.00000000	125.35672177	456.00000000	943.00000000	19.82063804	24920.000000	15714.307692	20.121
G=2 S=1 C=1 H=4 D=13									
PERT	40	1494.92500000	176.98968391	1307.00000000	1865.00000000	27.98436806	59797.000000	31324.994231	11.839
DECT	40	792.95000000	161.34757409	373.00000000	1015.00000000	25.51919715	31718.000000	26049.176923	20.354
MOVT	40	701.97500000	169.72090966	462.00000000	1131.00000000	26.83524012	28079.000000	28805.204487	24.178
G=2 S=1 C=1 H=4 D=16									
PERT	40	1312.20000000	91.81480803	1166.00000000	1454.00000000	14.51719582	52488.000000	8429.958974	6.997
DECT	40	617.05000000	97.36712181	398.00000000	786.00000000	15.39509371	24682.000000	9480.356410	15.779
MOVT	40	695.15000000	125.08633141	520.00000000	1050.00000000	19.77788684	27806.000000	15646.592308	17.994

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   10:39 TUESDAY, APRIL 11, 1978 1002

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
G=2 S=1 C=2 H=2 D=7									
PERT	40	926.22500000	62.83004650	795.00000000	1052.00000000	9.93430262	37049.000000	3947.6147436	6.783
DECT	40	435.70000000	54.28424714	322.00000000	575.00000000	8.58309310	17428.000000	2946.7794872	12.459
MOVT	40	490.52500000	57.08657256	422.00000000	647.00000000	9.02624290	19621.000000	3258.9224359	11.638
G=2 S=1 C=2 H=2 D=10									
PERT	40	974.10000000	63.29329369	846.00000000	1176.00000000	10.00754643	38964.000000	4006.0410256	6.498
DECT	40	404.15000000	38.01453838	305.00000000	473.00000000	6.01062627	16166.000000	1445.1051282	9.406
MOVT	40	569.95000000	49.25181241	503.00000000	703.00000000	7.78739531	22798.000000	2425.7410256	8.641
G=2 S=1 C=2 H=2 D=13									
PERT	40	1115.82500000	107.49737322	1003.00000000	1358.00000000	16.99682804	44633.000000	11555.686538	9.634
DECT	40	425.52500000	49.74137601	298.00000000	517.00000000	7.86480211	17021.000000	2474.204487	11.689
MOVT	40	690.30000000	91.62526904	542.00000000	913.00000000	14.48722691	27612.000000	8395.189744	13.273
G=2 S=1 C=2 H=2 D=16									
PERT	40	1088.50000000	68.33139459	979.00000000	1268.00000000	10.80414213	43540.000000	4669.1794872	6.220
DECT	40	408.95000000	38.40202318	316.00000000	492.00000000	6.07189300	16358.000000	1474.7153846	9.367
MOVT	40	688.55000000	45.44703377	614.00000000	776.00000000	7.18580777	27542.000000	2065.4333333	6.600
G=2 S=1 C=2 H=3 D=7									
PERT	40	1321.07500000	131.44471149	1012.00000000	1693.00000000	20.78323374	52843.000000	17277.712179	9.950
DECT	40	686.15000000	156.03263137	365.00000000	1152.00000000	24.67092522	27446.000000	24346.182051	22.740
MOVT	40	634.92500000	176.44297219	129.00000000	986.00000000	27.89808346	25397.000000	31132.122436	27.790
G=2 S=1 C=2 H=3 D=10									
PERT	40	1451.40000000	134.26720393	1248.00000000	1818.00000000	21.22950857	58056.000000	18027.682051	9.251
DECT	40	726.35000000	150.05322762	444.00000000	1157.00000000	23.72644716	29054.000000	22517.771795	20.659
MOVT	40	725.05000000	158.43108184	337.00000000	1122.00000000	25.05015354	29002.000000	25100.407692	21.851
G=2 S=1 C=2 H=3 D=13									
PERT	40	1463.37500000	150.65850117	1101.00000000	1774.00000000	23.82120063	58535.000000	22657.983974	10.295
DECT	40	688.90000000	95.51823561	489.00000000	965.00000000	15.10275913	27556.000000	9123.733333	13.865
MOVT	40	774.47500000	118.82932978	612.00000000	1160.00000000	18.78856675	30979.000000	14120.409615	15.343
G=2 S=1 C=2 H=3 D=16									
PERT	40	1525.80000000	168.17530336	1284.00000000	2139.00000000	26.59085056	61032.000000	28282.933333	11.022
DECT	40	694.02500000	146.44426392	386.00000000	1108.00000000	23.15487121	27761.000000	21445.922436	21.101
MOVT	40	831.77500000	132.59341243	540.00000000	1186.00000000	20.96090645	33271.000000	17574.383974	15.938
G=2 S=1 C=2 H=4 D=7									
PERT	40	1242.80000000	79.30214858	1111.00000000	1410.00000000	12.53877064	49712.000000	6288.8307692	6.381
DECT	40	711.00000000	76.55231159	589.00000000	851.00000000	12.10398324	28440.000000	5860.2564103	10.767
MOVT	40	531.80000000	62.28155341	425.00000000	626.00000000	9.84789448	21272.000000	3879.2410256	11.712
G=2 S=1 C=2 H=4 D=10									
PERT	40	1421.65000000	101.89399372	1212.00000000	1712.00000000	16.11085595	56866.000000	10382.387179	7.167
DECT	40	803.75000000	86.93321918	588.00000000	855.00000000	13.74566365	32150.000000	7557.730769	10.816
MOVT	40	617.90000000	123.87624097	484.00000000	855.00000000	19.58655347	24716.000000	15345.323077	20.048
G=2 S=1 C=2 H=4 D=13									
PERT	40	1475.40000000	66.64517602	1317.00000000	1582.00000000	10.53752756	59016.000000	4441.5794872	4.517
DECT	40	839.75000000	69.66540314	655.00000000	988.00000000	11.01506635	33590.000000	4853.2692308	8.296
MOVT	40	635.65000000	62.16749501	507.00000000	733.00000000	9.82954403	25426.000000	3864.7974359	9.780
G=2 S=1 C=2 H=4 D=16									
PERT	40	1422.35000000	119.25636036	1209.00000000	1634.00000000	18.85608621	56894.000000	14222.079487	8.384
DECT	40	757.65000000	71.48912415	635.00000000	925.00000000	11.30342301	30306.000000	5110.694872	9.436
MOVT	40	664.70000000	106.59706962	536.00000000	907.00000000	16.85447517	26588.000000	11362.933333	16.037

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G=2 S=1 C=3 H=2 D=7

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	995.30000000	98.50591136	856.00000000	1326.00000000	15.57513633	39812.000000	9703.3948718	9.897
DECT	40	398.72500000	86.48787895	254.00000000	605.00000000	13.67493437	15549.000000	7480.1532051	21.691
MOVT	40	596.57500000	72.54596686	486.00000000	805.00000000	11.47052452	23863.000000	5262.9173077	12.160
G=2 S=1 C=3 H=2 D=10									
PERT	40	1067.15000000	65.39734240	968.00000000	1212.00000000	10.32631379	42686.000000	4265.3102564	6.120
DECT	40	387.45000000	56.92951359	252.00000000	495.00000000	9.00134961	15498.000000	3240.9717949	14.693
MOVT	40	679.70000000	28.85080988	580.00000000	737.00000000	4.56171358	27188.000000	832.3692308	4.245
G=2 S=1 C=3 H=2 D=13									
PERT	40	1154.67500000	102.29554656	987.00000000	1521.00000000	16.17434608	46187.000000	10464.378846	8.859
DECT	40	365.27500000	57.64301612	238.00000000	507.00000000	9.11416111	14611.000000	3322.717308	15.781
MOVT	40	789.40000000	101.67565324	617.00000000	1173.00000000	16.07633234	31576.000000	10337.938462	12.880
G=2 S=1 C=3 H=2 D=16									
PERT	40	1318.50000000	134.44396412	1060.00000000	1755.00000000	21.25745721	52740.000000	18075.179487	10.197
DECT	40	413.72500000	87.54337796	272.00000000	700.00000000	13.84191829	16549.000000	7663.948077	21.160
MOVT	40	904.77500000	128.35356858	707.00000000	1507.00000000	20.29542981	36191.000000	16476.178846	14.187
G=2 S=1 C=3 H=3 D=7									
PERT	40	1177.32500000	179.65984776	917.00000000	1657.00000000	28.40671615	47093.000000	32277.660897	15.260
DECT	40	620.97500000	68.36759148	477.00000000	752.00000000	10.80986536	24839.000000	4674.127564	11.010
MOVT	40	556.35000000	148.01655313	401.00000000	905.00000000	23.40347196	22254.000000	21908.900000	26.605
G=2 S=1 C=3 H=3 D=10									
PERT	40	1224.40000000	151.29659427	1010.00000000	1631.00000000	23.92209042	48976.000000	22890.656410	12.357
DECT	40	622.60000000	166.24631093	223.00000000	1045.00000000	26.28584976	24904.000000	27637.835897	26.702
MOVT	40	601.80000000	103.74925394	453.00000000	848.00000000	16.40415740	24072.000000	10763.907692	17.240
G=2 S=1 C=3 H=3 D=13									
PERT	40	1265.82500000	111.30859810	1104.00000000	1524.00000000	17.59942043	50633.000000	12389.583974	8.793
DECT	40	627.90000000	103.50617472	444.00000000	915.00000000	16.36576320	25116.000000	10713.528205	16.484
MOVT	40	637.92500000	71.48383776	506.00000000	789.00000000	11.30290339	25517.000000	5110.225000	11.206
G=2 S=1 C=3 H=3 D=16									
PERT	40	1377.77500000	181.42067384	1108.00000000	1765.00000000	28.68512720	55111.000000	32913.460897	13.168
DECT	40	626.17500000	104.76075001	489.00000000	848.00000000	16.56412897	25047.000000	10974.814744	16.730
MOVT	40	751.60000000	157.74432413	458.00000000	1065.00000000	24.94156761	30064.000000	24883.271795	20.988
G=2 S=1 C=3 H=4 D=7									
PERT	40	1219.77500000	207.85417565	910.00000000	1808.00000000	32.86463081	48791.000000	43203.358333	17.040
DECT	40	629.27500000	166.92344130	214.00000000	965.00000000	26.39291347	25171.000000	27863.435256	26.526
MOVT	40	590.50000000	167.92840355	400.00000000	1023.00000000	26.55181195	23620.000000	28199.948718	28.438
G=2 S=1 C=3 H=4 D=10									
PERT	40	1377.97500000	130.34716711	1148.00000000	1744.00000000	20.60965673	55119.000000	16990.383974	9.459
DECT	40	736.37500000	142.92398683	349.00000000	1003.00000000	22.59826654	29455.000000	20427.266026	19.409
MOVT	40	641.60000000	140.72227604	491.00000000	950.00000000	22.25014949	25664.000000	19802.758974	21.933
G=2 S=1 C=3 H=4 D=13									
PERT	40	1437.25000000	185.98645526	1206.00000000	1966.00000000	29.40704063	57490.000000	34590.961538	12.940
DECT	40	766.45000000	147.26079256	490.00000000	1207.00000000	23.28397573	30658.000000	21685.741026	19.213
MOVT	40	670.80000000	148.84602266	510.00000000	1045.00000000	23.53462261	26832.000000	22155.138462	22.189
G=2 S=1 C=3 H=4 D=16									
PERT	40	1383.47500000	177.70646994	1150.00000000	1865.00000000	28.09785584	55339.000000	31575.589103	12.845
DECT	40	686.60000000	85.62174461	410.00000000	922.00000000	13.53830274	27464.000000	7331.425641	12.471
MOVT	40	696.87500000	168.77221601	511.00000000	1160.00000000	26.68523042	27875.000000	28484.060897	24.218

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VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
G=2 S=1 C=4 H=2 D=7									
PERT	40	1073.92500000	117.88768329	911.00000000	1311.00000000	18.63968016	42957.000000	13897.507051	10.977
DECT	40	356.50000000	52.03351977	289.00000000	471.00000000	8.22722186	14340.000000	2707.487179	14.514
MOVT	40	715.42500000	121.20313263	539.00000000	961.00000000	19.16389793	28617.000000	14690.199359	16.941
G=2 S=1 C=4 H=2 D=10									
PERT	40	1077.70000000	52.64452634	952.00000000	1171.00000000	8.32383048	43108.000000	2771.4461538	4.885
DECT	40	359.42500000	54.33792060	218.00000000	442.00000000	8.59157962	14377.000000	2952.6096154	15.118
MOVT	40	718.27500000	53.96579520	610.00000000	813.00000000	8.53274143	28731.000000	2912.3070513	7.513
G=2 S=1 C=4 H=2 D=13									
PERT	40	1281.02500000	161.93358691	1018.00000000	1548.00000000	25.60394820	51241.000000	26222.486538	12.641
DECT	40	360.90000000	53.52967066	274.00000000	458.00000000	8.46378408	14436.000000	2865.425641	14.832
MOVT	40	920.12500000	156.38466505	744.00000000	1197.00000000	24.72658663	36805.000000	24456.163462	16.996
G=2 S=1 C=4 H=2 D=16									
PERT	40	1240.67500000	81.67807931	1111.00000000	1379.00000000	12.94606105	49627.000000	6704.019872	6.599
DECT	40	374.37500000	72.00487430	275.00000000	512.00000000	11.38497027	14975.000000	5184.701923	19.233
MOVT	40	866.30000000	108.06341918	656.00000000	1012.00000000	17.08632682	34652.000000	11677.702564	12.474
G=2 S=1 C=4 H=3 D=7									
PERT	40	1226.90000000	107.39163889	1080.00000000	1462.00000000	15.98010903	49076.000000	11532.964103	8.753
DECT	40	528.92500000	75.35433818	437.00000000	766.00000000	11.91456701	21157.000000	5678.276282	14.247
MOVT	40	697.97500000	92.63977312	586.00000000	1025.00000000	14.64763425	27919.000000	8582.127564	13.273
G=2 S=1 C=4 H=3 D=10									
PERT	40	1254.02500000	86.75975993	1106.00000000	1376.00000000	13.71792237	50161.000000	7527.2557692	6.919
DECT	40	534.32500000	77.99157992	449.00000000	703.00000000	12.33155154	21373.000000	6082.6865385	14.596
MOVT	40	719.70000000	53.00227378	613.00000000	828.00000000	8.38039532	28788.000000	2809.2410256	7.364
G=2 S=1 C=4 H=3 D=13									
PERT	40	1476.22500000	169.83498590	1241.00000000	1765.00000000	26.85326909	59049.000000	28843.922436	11.505
DECT	40	596.30000000	77.28740900	418.00000000	755.00000000	12.22021234	23852.000000	5973.343590	12.961
MOVT	40	879.92500000	171.23773112	605.00000000	1285.00000000	27.07537881	35197.000000	29323.045513	19.461
G=2 S=1 C=4 H=3 D=16									
PERT	40	1481.05000000	194.04862594	1218.00000000	1921.00000000	30.68178174	59242.000000	37654.869231	13.102
DECT	40	498.40000000	54.32324902	424.00000000	582.00000000	8.58925984	19936.000000	2951.015385	10.900
MOVT	40	982.65000000	175.65256354	780.00000000	1425.00000000	27.77310888	39306.000000	30853.823077	17.875
G=2 S=1 C=4 H=4 D=7									
PERT	40	1597.67500000	204.21373764	1307.00000000	1976.00000000	32.28902702	63907.000000	41703.250641	12.782
DECT	40	822.57500000	192.42206381	565.00000000	1186.00000000	30.42459969	32903.000000	37026.250641	23.393
MOVT	40	775.10000000	114.15077748	646.00000000	1031.00000000	18.04882268	31004.000000	13030.400000	14.727
G=2 S=1 C=4 H=4 D=10									
PERT	40	1698.10000000	245.67122078	1306.00000000	2204.00000000	38.84403066	67924.000000	60354.348718	14.467
DECT	40	793.10000000	125.42207364	604.00000000	1067.00000000	19.83065485	31724.000000	15730.194872	15.814
MOVT	40	905.00000000	183.06591219	660.00000000	1358.00000000	28.94526222	36200.000000	33513.128205	20.228
G=2 S=1 C=4 H=4 D=13									
PERT	40	1575.15000000	142.55355269	1385.00000000	1932.00000000	22.53969575	63006.000000	20321.515385	9.050
DECT	40	725.22500000	95.49479446	474.00000000	864.00000000	15.09905276	29009.000000	9119.255769	13.168
MOVT	40	849.92500000	118.02376716	664.00000000	1050.00000000	18.66119611	33997.000000	13929.609615	13.886
G=2 S=1 C=4 H=4 D=16									
PERT	40	1473.32500000	158.45024901	1254.00000000	1935.00000000	25.05318413	58933.000000	25106.481410	10.755
DECT	40	617.35000000	51.98005941	556.00000000	737.00000000	8.21876761	24694.000000	2701.925641	8.420
MOVT	40	855.97500000	157.10938334	677.00000000	1210.00000000	24.84117466	34239.000000	24683.358333	18.354

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G=2 S=2 C=1 H=2 D=7

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1383.37500000	142.66271637	1113.00000000	1632.00000000	22.55695605	55335.000000	20352.650641	10.313
DFCT	40	631.55000000	168.23029850	242.00000000	966.00000000	26.59954574	25262.000000	28301.433333	26.638
MOVT	40	751.82500000	155.66793842	568.00000000	1260.00000000	24.61326220	30073.000000	24232.507051	20.705

G=2 S=2 C=1 H=2 D=10

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1380.15000000	143.14105469	1125.00000000	1681.00000000	22.63258798	55206.000000	20489.361538	10.371
DFCT	40	514.15000000	161.56677591	235.00000000	836.00000000	25.54595030	20566.000000	26103.823077	31.424
MOVT	40	866.00000000	179.23555623	461.00000000	1234.00000000	28.33962977	34640.000000	32125.384615	20.697

G=2 S=2 C=1 H=2 D=13

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1600.20000000	168.48285312	1129.00000000	2064.00000000	26.63947813	64008.000000	28386.471795	10.529
DFCT	40	620.50000000	177.83512964	237.00000000	892.00000000	28.11820288	24820.000000	31625.333333	28.660
MOVT	40	879.70000000	184.24303904	642.00000000	1410.00000000	29.13136232	35188.000000	33945.497436	18.806

G=2 S=2 C=1 H=2 D=16

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1639.27500000	190.92594718	1362.00000000	2041.00000000	30.18804288	65571.000000	36452.717308	11.647
DFCT	40	658.37500000	247.90058379	236.00000000	1165.00000000	39.19652469	26335.000000	61454.701923	37.653
MOVT	40	980.90000000	184.16280423	693.00000000	1445.00000000	29.11869608	39236.000000	33915.938462	18.775

G=2 S=2 C=1 H=3 D=7

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1450.20000000	85.13193381	1296.00000000	1614.00000000	13.46054062	58008.000000	7247.446154	5.870
DFCT	40	674.47500000	134.28633539	355.00000000	935.00000000	21.23253392	26979.000000	18032.819872	19.910
MOVT	40	775.72500000	131.73127026	547.00000000	1042.00000000	20.82854265	31029.000000	17353.127564	16.982

G=2 S=2 C=1 H=3 D=10

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1510.57500000	185.53829653	1105.00000000	1815.00000000	29.33617893	60423.000000	34424.455769	12.283
DFCT	40	623.37500000	102.44840790	304.00000000	865.00000000	16.19851558	24935.000000	10495.676282	16.434
MOVT	40	887.20000000	195.37107363	614.00000000	1392.00000000	30.89087508	35488.000000	38169.856410	22.021

G=2 S=2 C=1 H=3 D=13

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1533.27500000	131.68980404	1252.00000000	1965.00000000	20.82198627	61331.000000	17342.204487	8.589
DFCT	40	608.62500000	158.52740963	327.00000000	966.00000000	25.06570053	24345.000000	25131.573718	26.047
MOVT	40	924.05000000	193.39511170	675.00000000	1476.00000000	30.57845207	36962.000000	37401.669231	20.915

G=2 S=2 C=1 H=3 D=16

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1668.17500000	257.63270292	1255.00000000	2318.00000000	40.73530705	66727.000000	66374.605615	15.444
DFCT	40	726.32500000	232.46796167	279.00000000	1359.00000000	36.75641210	29053.000000	54041.353205	32.006
MOVT	40	941.85000000	190.91447273	568.00000000	1462.00000000	30.18622861	37674.000000	36448.335897	20.270

G=2 S=2 C=1 H=4 D=7

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1878.47500000	218.09701294	1581.00000000	2372.00000000	34.48416559	75139.000000	47566.307051	11.610
DFCT	40	1119.20000000	296.37019470	594.00000000	1772.00000000	46.86024229	44768.000000	87835.292308	26.481
MOVT	40	759.27500000	284.90592127	362.00000000	1553.00000000	45.04758150	30371.000000	81171.383974	37.523

G=2 S=2 C=1 H=4 D=10

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1926.65000000	188.45396498	1527.00000000	2260.00000000	29.79712493	77066.000000	35514.746154	9.781
DFCT	40	1048.00000000	243.62737740	227.00000000	1542.00000000	38.52082354	41920.000000	59354.153846	23.247
MOVT	40	878.65000000	264.76395160	394.00000000	1871.00000000	41.86601875	35146.000000	70110.541026	30.135

G=2 S=2 C=1 H=4 D=13

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1910.97500000	178.21097947	1581.00000000	2505.00000000	28.17762596	76439.000000	31759.153205	9.326
DFCT	40	1018.40000000	210.92176214	576.00000000	1652.00000000	33.34965882	40736.000000	44487.989744	20.711
MOVT	40	892.57500000	210.01073380	507.00000000	1561.00000000	33.20561212	35703.000000	44104.507051	23.529

G=2 S=2 C=1 H=4 D=16

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1905.95000000	140.52357532	1636.00000000	2228.00000000	22.21967683	76238.000000	19748.561538	7.373
DFCT	40	936.72500000	213.02461487	384.00000000	1374.00000000	33.68214903	37469.000000	45379.486538	22.741
MOVT	40	969.22500000	198.16548331	559.00000000	1478.00000000	31.33277729	38769.000000	39269.717308	20.446

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G=2 S=2 C=2 H=2 D=7

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1275.05000000	160.57215503	1011.00000000	1868.00000000	25.45206530	51002.000000	25912.305128	12.625
DECT	40	590.92500000	174.70757803	263.00000000	974.00000000	27.62369355	23637.000000	30522.737821	29.565
MOVT	40	684.12500000	205.57364237	367.00000000	1108.00000000	32.50404684	27365.000000	42260.522436	30.049
G=2 S=2 C=2 H=2 D=10									
PERT	40	1394.62500000	144.04747926	1125.00000000	1655.00000000	22.77590628	55785.000000	20749.676282	10.329
DECT	40	605.52500000	170.32035391	322.00000000	1025.00000000	26.93001346	24221.000000	29009.025000	28.128
MOVT	40	789.10000000	178.71848655	511.00000000	1132.00000000	28.25787387	31564.000000	31940.297436	22.648
G=2 S=2 C=2 H=2 D=13									
PERT	40	1473.50000000	205.87412136	1024.00000000	2013.00000000	32.55155674	58940.000000	42384.153846	13.972
DECT	40	548.60000000	196.66994348	207.00000000	841.00000000	31.09624843	21944.000000	38679.066667	35.849
MOVT	40	924.90000000	244.53596034	593.00000000	1562.00000000	38.66453022	36996.000000	59797.835897	26.439
G=2 S=2 C=2 H=2 D=16									
PERT	40	1572.85000000	175.90258814	1245.00000000	1961.00000000	27.81264124	62914.000000	30941.720513	11.184
DECT	40	622.30000000	175.47024001	242.00000000	970.00000000	27.74428100	24892.000000	30789.805128	28.197
MOVT	40	950.55000000	234.19178531	529.00000000	1485.00000000	37.02897254	38022.000000	54845.792308	24.638
G=2 S=2 C=2 H=3 D=7									
PERT	40	1621.42500000	336.87393119	1199.00000000	2505.00000000	53.26444534	64857.000000	113484.04551	20.776
DECT	40	778.92500000	200.98378001	243.00000000	1158.00000000	31.77927456	31157.000000	40396.89167	25.803
MOVT	40	842.50000000	218.32227414	546.00000000	1361.00000000	34.51978251	33700.000000	47664.61538	25.914
G=2 S=2 C=2 H=3 D=10									
PERT	40	1596.27500000	185.62285827	1322.00000000	1996.00000000	29.34955090	63851.000000	34455.845513	11.629
DECT	40	737.00000000	172.57328432	243.00000000	1058.00000000	27.28623209	29480.000000	29781.538462	23.416
MOVT	40	859.27500000	146.37039424	645.00000000	1385.00000000	23.14314396	34371.000000	21424.204487	17.034
G=2 S=2 C=2 H=3 D=13									
PERT	40	1588.47500000	126.90880786	1377.00000000	1920.00000000	20.06604440	63539.000000	16105.845513	7.989
DECT	40	723.05000000	188.48708723	278.00000000	1086.00000000	29.80242526	28922.000000	35527.382051	26.068
MOVT	40	865.42500000	124.67658417	613.00000000	1191.00000000	19.71305884	34617.000000	15544.250641	14.406
G=2 S=2 C=2 H=3 D=16									
PERT	40	1731.67500000	212.22924078	1401.00000000	2250.00000000	33.55638935	69267.000000	45041.250641	12.256
DECT	40	712.17500000	185.21725116	308.00000000	1092.00000000	29.28541878	28487.000000	34305.430128	26.007
MOVT	40	1019.50000000	232.52273117	585.00000000	1942.00000000	36.76507191	40780.000000	54066.820513	22.808
G=2 S=2 C=2 H=4 D=7									
PERT	40	1640.20000000	201.07695763	1340.00000000	2362.00000000	31.79306488	65608.000000	40431.958974	12.259
DECT	40	962.82500000	217.00453587	412.00000000	1334.00000000	34.31142980	38513.000000	47090.968590	22.538
MOVT	40	677.37500000	215.84095373	165.00000000	1239.00000000	34.12745131	27095.000000	46587.317308	31.864
G=2 S=2 C=2 H=4 D=10									
PERT	40	2006.62500000	240.03500689	1537.00000000	2706.00000000	37.95286698	80265.000000	57616.804487	11.962
DECT	40	1109.52500000	248.76432957	328.00000000	1502.00000000	39.33309410	44381.000000	61883.691667	22.421
MOVT	40	897.10000000	224.72613532	412.00000000	1407.00000000	35.53232187	35884.000000	50501.835897	25.050
G=2 S=2 C=2 H=4 D=13									
PERT	40	1846.37500000	211.91963734	1451.00000000	2412.00000000	33.50743675	73855.000000	44909.932692	11.478
DECT	40	954.72500000	304.58412063	433.00000000	1543.00000000	48.15897802	38189.000000	92771.486538	31.903
MOVT	40	891.65000000	278.33613234	513.00000000	1457.00000000	44.00880667	35666.000000	77471.002564	31.216
G=2 S=2 C=2 H=4 D=16									
PERT	40	1887.70000000	294.21187203	1440.00000000	2728.00000000	46.51898151	75508.000000	86560.625641	15.586
DECT	40	929.15000000	284.81442901	264.00000000	1480.00000000	45.03311531	37166.000000	81119.258974	30.653
MOVT	40	956.05000000	258.42719956	347.00000000	1752.00000000	40.86092657	38242.000000	66784.612821	26.960

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VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
G=2 S=2 C=3 H=2 D=7									
PERT	40	1326.22500000	126.18930913	972.00000000	1556.00000000	19.95223423	53049.000000	15923.666026	9.515
DECT	40	563.60000000	147.08462591	267.00000000	832.00000000	23.25612133	22544.000000	21633.887179	26.097
MOVT	40	762.62500000	125.14026745	575.00000000	1054.00000000	19.78641361	30505.000000	15660.086538	16.409
G=2 S=2 C=3 H=2 D=10									
PERT	40	1461.07500000	131.04516452	1133.00000000	1737.00000000	20.72006297	58443.000000	17172.840385	8.969
DECT	40	597.12500000	141.02121817	299.00000000	877.00000000	22.29741239	23885.000000	19886.983974	23.617
MOVT	40	863.95000000	131.04412058	678.00000000	1161.00000000	20.71989475	34558.000000	17172.561538	15.168
G=2 S=2 C=3 H=2 D=13									
PERT	40	1517.85000000	129.72983797	1293.00000000	1750.00000000	20.51208368	60714.000000	16829.823077	8.547
DECT	40	570.90000000	135.43884386	266.00000000	950.00000000	21.41476246	22836.000000	18343.682051	23.724
MOVT	40	946.95000000	124.95208312	780.00000000	1239.00000000	19.75665905	37878.000000	15613.023077	13.195
G=2 S=2 C=3 H=2 D=16									
PERT	40	1614.00000000	135.90418948	1469.00000000	1858.00000000	21.48833912	64560.000000	18469.948718	8.420
DECT	40	608.42500000	109.98225673	402.00000000	921.00000000	17.38972167	24337.000000	12096.096795	18.077
MOVT	40	1005.57500000	134.85085344	812.00000000	1382.00000000	21.32175839	40223.000000	18184.763462	13.410
G=2 S=2 C=3 H=3 D=7									
PERT	40	1598.62500000	174.13503271	1306.00000000	2017.00000000	27.53316619	63945.000000	30323.009615	10.893
DECT	40	712.60000000	178.86806483	295.00000000	1085.00000000	28.28152428	28504.000000	31993.784615	25.101
MOVT	40	886.02500000	179.75175011	663.00000000	1394.00000000	28.42124719	35441.000000	32310.691667	20.287
G=2 S=2 C=3 H=3 D=10									
PERT	40	1676.22500000	162.41834043	1307.00000000	2066.00000000	25.68059448	67049.000000	26379.717308	9.690
DECT	40	718.47500000	202.08549813	218.00000000	1148.00000000	31.95250858	28739.000000	40838.512179	28.127
MOVT	40	957.75000000	182.96934730	624.00000000	1428.00000000	28.92999397	38310.000000	33477.782051	19.104
G=2 S=2 C=3 H=3 D=13									
PERT	40	1724.65000000	203.07413702	1378.00000000	2221.00000000	32.10884034	68986.000000	41239.105128	11.775
DECT	40	722.50000000	211.55177580	377.00000000	1231.00000000	33.44927273	28900.000000	44754.153846	29.281
MOVT	40	1002.15000000	230.40416552	716.00000000	1600.00000000	36.43009727	40086.000000	53086.079487	22.991
G=2 S=2 C=3 H=3 D=16									
PERT	40	1872.92500000	228.29854358	1416.00000000	2413.00000000	36.09716521	74917.000000	52120.225000	12.189
DECT	40	824.62500000	220.90915728	476.00000000	1338.00000000	34.92880465	32985.000000	48800.855769	26.789
MOVT	40	1048.30000000	189.45525147	687.00000000	1581.00000000	29.95550547	41932.000000	35893.292308	18.073
G=2 S=2 C=3 H=4 D=7									
PERT	40	1962.02500000	155.76304942	1701.00000000	2288.00000000	24.62830057	78481.000000	24262.12756	7.939
DECT	40	1025.77500000	377.53848420	235.00000000	1475.00000000	59.69407572	41031.000000	142535.30705	36.805
MOVT	40	936.25000000	407.29933183	482.00000000	1827.00000000	64.39971084	37450.000000	165892.91026	43.503
G=2 S=2 C=3 H=4 D=10									
PERT	40	2160.02500000	231.26779765	1707.00000000	2656.00000000	36.56664950	86401.000000	53484.794231	10.707
DECT	40	1143.05000000	240.61651051	364.00000000	1644.00000000	38.04481079	45722.000000	57896.305128	19.357
MOVT	40	916.97500000	233.17094945	653.00000000	1817.00000000	36.86756422	36679.000000	54368.691667	25.428
G=2 S=2 C=3 H=4 D=13									
PERT	40	1997.25000000	217.66905136	1701.00000000	2395.00000000	34.41650525	79890.000000	47379.833333	10.898
DECT	40	1220.37500000	225.16759428	893.00000000	1625.00000000	35.60212266	48815.000000	50700.445513	18.451
MOVT	40	776.87500000	115.85596207	575.00000000	1043.00000000	18.32471315	31075.000000	13431.604487	14.918
G=2 S=2 C=3 H=4 D=16									
PERT	40	2115.25000000	198.78435036	1755.00000000	2449.00000000	31.43056552	84610.000000	39515.217949	9.398
DECT	40	1153.10000000	310.54276719	265.00000000	1492.00000000	49.10112276	46124.000000	96436.810256	26.931
MOVT	40	962.15000000	275.85582912	686.00000000	1955.00000000	43.61663629	38486.000000	76096.438462	28.671

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G=2 S=2 C=4 H=2 D=7

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
PERT	40	1443.47500000	132.66759177	1154.00000000	1724.00000000	20.97657385	57739.000000	17600.666026	9.159
DECT	40	502.42500000	102.59476857	203.00000000	682.00000000	16.22165724	20097.000000	10525.686538	20.420
MOVT	40	946.05000000	114.41175079	673.00000000	1230.00000000	18.09008618	37842.000000	13090.048718	12.094
G=2 S=2 C=4 H=2 D=10									
PERT	40	1457.60000000	159.84380196	1217.00000000	1776.00000000	25.27352420	58304.000000	25550.041026	10.966
DECT	40	529.15000000	133.46558743	227.00000000	765.00000000	21.10339473	21166.000000	17814.130769	25.223
MOVT	40	928.45000000	144.35336807	670.00000000	1247.00000000	22.82427155	37138.000000	20837.894872	15.548
G=2 S=2 C=4 H=2 D=13									
PERT	40	1580.20000000	168.78740791	1305.00000000	1952.00000000	26.68763278	63208.000000	28489.189744	10.681
DECT	40	550.75000000	150.17523952	209.00000000	840.00000000	23.74479025	22030.000000	22552.602564	27.267
MOVT	40	1029.45000000	154.87214744	619.00000000	1381.00000000	24.48743660	41178.000000	23985.382051	15.044
G=2 S=2 C=4 H=2 D=16									
PERT	40	1838.35000000	418.40138684	1376.00000000	2752.00000000	66.15506793	73534.000000	175059.72051	22.760
DECT	40	515.67500000	101.90477896	301.00000000	658.00000000	16.11256030	20627.000000	10384.58397	19.761
MOVT	40	1322.67500000	395.89770673	883.00000000	2151.00000000	62.59692369	52907.000000	156734.99423	29.932
G=2 S=2 C=4 H=3 D=7									
PERT	40	1653.10000000	136.54243259	1406.00000000	1915.00000000	21.58925421	66124.000000	18643.835897	8.260
DECT	40	680.92500000	149.15546656	325.00000000	900.00000000	23.58354599	27237.000000	22247.353205	21.905
MOVT	40	972.17500000	177.27349398	792.00000000	1361.00000000	28.02940049	38887.000000	31425.891667	18.235
G=2 S=2 C=4 H=3 D=10									
PERT	40	1809.95000000	219.77435398	1432.00000000	2295.00000000	34.74937649	72398.000000	48300.766667	12.143
DECT	40	720.17500000	145.50282181	425.00000000	1025.00000000	23.00601614	28807.000000	21171.071154	20.204
MOVT	40	1089.77500000	229.11205270	509.00000000	1652.00000000	36.22579630	43591.000000	52492.332692	21.024
G=2 S=2 C=4 H=3 D=13									
PERT	40	1780.92500000	258.09403847	1412.00000000	2363.00000000	40.80825060	71237.000000	66612.532692	14.492
DECT	40	722.72500000	209.90571601	213.00000000	1117.00000000	33.18900782	28909.000000	44060.409615	29.044
MOVT	40	1058.20000000	188.45895969	806.00000000	1584.00000000	29.79797790	42328.000000	35516.779487	17.809
G=2 S=2 C=4 H=3 D=16									
PERT	40	1918.02500000	225.24795312	1524.00000000	2506.00000000	35.61482851	76721.000000	50736.640385	11.744
DECT	40	739.95000000	97.78363085	552.00000000	1026.00000000	15.46094557	29598.000000	9561.638462	13.215
MOVT	40	1178.07500000	194.96539963	904.00000000	1606.00000000	30.82673639	47123.000000	38011.507051	16.549
G=2 S=2 C=4 H=4 D=7									
PERT	40	1848.22500000	176.06489006	1346.00000000	2130.00000000	27.83830343	73929.000000	30998.84551	9.526
DECT	40	825.22500000	245.59352362	398.00000000	1358.00000000	38.83174566	33009.000000	60316.17885	29.761
MOVT	40	1023.00000000	333.44064939	236.00000000	1611.00000000	52.72159583	40920.000000	111182.66667	32.594
G=2 S=2 C=4 H=4 D=10									
PERT	40	2167.25000000	213.20782566	1710.00000000	2711.00000000	33.71111720	86690.000000	45457.576923	9.838
DECT	40	767.75000000	158.25392155	455.00000000	1106.00000000	25.02198392	30710.000000	25043.987179	20.613
MOVT	40	1394.50000000	235.56261076	917.00000000	1884.00000000	37.24571908	55780.000000	55489.743590	16.832
G=2 S=2 C=4 H=4 D=13									
PERT	40	1998.05000000	242.56597834	1616.00000000	2721.00000000	38.35304872	79922.000000	58838.253846	12.140
DECT	40	871.02500000	249.15595561	545.00000000	1725.00000000	39.39495580	34841.000000	62078.640385	28.605
MOVT	40	1127.02500000	133.37400189	950.00000000	1405.00000000	21.08829082	45081.000000	17788.640385	11.834
G=2 S=2 C=4 H=4 D=16									
PERT	40	1972.70000000	190.02939948	1554.00000000	2420.00000000	30.04627201	78908.000000	36111.138462	9.633
DECT	40	777.25000000	211.82498534	297.00000000	1385.00000000	33.49245514	31090.000000	44869.782051	27.253
MOVT	40	1195.45000000	207.04105254	789.00000000	1576.00000000	32.73606476	47818.000000	42865.997436	17.319

C.2 Means of the % of heart rate increase

***** % INCREASE IN HEART RATE OF THE SUBJECTS *****   12:22 FRIDAY, JUNE 9, 1978   1

OBS	G	S	C	H	R
1	1	1	1	2	0.008
2	1	1	1	3	0.039
3	1	1	1	4	0.005
4	1	1	4	2	0.080
5	1	1	4	3	0.028
6	1	1	4	4	0.041
7	1	2	1	2	0.000
8	1	2	1	3	0.019
9	1	2	1	4	0.042
10	1	2	4	2	0.003
11	1	2	4	3	0.012
12	1	2	4	4	0.004
13	1	3	1	2	0.035
14	1	3	1	3	0.030
15	1	3	1	4	0.000
16	1	3	4	2	0.032
17	1	3	4	3	0.040
18	1	3	4	4	0.036
19	1	4	1	2	0.006
20	1	4	1	3	0.012
21	1	4	1	4	0.004
22	1	4	4	2	0.019
23	1	4	4	3	0.001
24	1	4	4	4	0.069
25	1	5	1	2	0.016
26	1	5	1	3	0.039
27	1	5	1	4	0.022
28	1	5	4	2	0.001
29	1	5	4	3	0.021
30	1	5	4	4	0.035
31	1	6	1	2	0.013
32	1	6	1	3	0.005
33	1	6	1	4	0.003
34	1	6	4	3	0.044
35	1	6	4	2	0.001
36	1	6	4	4	0.016
37	1	7	1	2	0.030
38	1	7	1	3	0.067
39	1	7	1	4	0.064
40	1	7	4	2	0.073
41	1	7	4	3	0.058
42	1	7	4	4	0.040
43	1	8	1	2	0.011
44	1	8	1	3	0.047
45	1	8	1	4	0.039
46	1	8	4	2	0.032
47	1	8	4	3	0.118
48	1	8	4	4	0.063
49	1	9	1	2	0.070
50	1	9	1	3	0.060
51	1	9	1	4	0.077
52	1	9	4	2	0.055
53	1	9	4	3	0.069
54	1	9	4	4	0.049
55	1	10	1	2	0.000
56	1	10	1	3	0.010
57	1	10	1	4	0.027
58	1	10	4	2	0.006
59	1	10	4	3	0.011
60	1	10	4	4	0.015
61	2	1	1	2	0.013
62	2	1	1	3	0.001
63	2	1	1	4	0.003
64	2	1	4	2	0.055
65	2	1	4	3	0.029
66	2	1	4	4	0.097
67	2	2	1	2	0.015
68	2	2	1	3	0.013
69	2	2	1	4	0.047
70	2	2	4	2	0.013
71	2	2	4	3	0.015
72	2	2	4	4	0.097
73	2	3	1	2	0.030
74	2	3	1	3	0.033

OBS	G	S	C	H	R
75	2	3	1	4	0.068
76	2	3	4	2	0.000
77	2	3	4	3	0.044
78	2	3	4	4	0.051
79	2	4	1	2	0.000
80	2	4	1	3	0.019
81	2	4	1	4	0.048
82	2	4	4	2	0.003
83	2	4	4	3	0.016
84	2	4	4	4	0.042
85	2	5	1	2	0.101
86	2	5	1	3	0.105
87	2	5	1	4	0.037
88	2	5	4	2	0.108
89	2	5	4	3	0.072
90	2	5	4	4	0.095
91	2	6	1	2	0.003
92	2	6	1	3	0.010
93	2	6	1	4	0.019
94	2	6	4	2	0.030
95	2	6	4	3	0.003
96	2	6	4	4	0.017
97	2	7	1	2	0.001
98	2	7	1	3	0.053
99	2	7	1	4	0.026
100	2	7	4	2	0.036
101	2	7	4	3	0.041
102	2	7	4	4	0.069
103	2	8	1	2	0.061
104	2	8	1	3	0.094
105	2	8	1	4	0.066
106	2	8	4	2	0.109
107	2	8	4	3	0.120
108	2	8	4	4	0.091
109	2	9	1	2	0.015
110	2	9	1	3	0.012
111	2	9	1	4	0.024
112	2	9	4	2	0.048
113	2	9	4	3	0.071
114	2	9	4	4	0.051
115	2	10	1	2	0.041
116	2	10	1	3	0.012
117	2	10	1	4	0.004
118	2	10	4	2	0.035
119	2	10	4	3	0.045
120	2	10	4	4	0.014

C.3 % of Performance Errors

****** PERCENTAGE OF [illegible] ERRORS ******   12:18 FRIDAY, JUNE 9, 1978   1

OBS	G	S	C	H	P_ERROR
1	1	1	1	2	0.0000
2	1	1	1	3	0.0000
3	1	1	1	4	0.0050
4	1	1	2	2	0.0000
5	1	1	2	3	0.0000
6	1	1	2	4	0.0100
7	1	1	3	2	0.0000
8	1	1	3	3	0.0000
9	1	1	3	4	0.0200
10	1	1	4	2	0.0000
11	1	1	4	3	0.0000
12	1	1	4	4	0.0100
13	1	2	1	2	0.0050
14	1	2	1	3	0.0000
15	1	2	1	4	0.0200
16	1	2	2	2	0.0050
17	1	2	2	3	0.0000
18	1	2	2	4	0.0144
19	1	2	3	2	0.0000
20	1	2	3	3	0.0050
21	1	2	3	4	0.0000
22	1	2	4	2	0.0000
23	1	2	4	3	0.0000
24	1	2	4	4	0.0100
25	1	3	1	2	0.0000
26	1	3	1	3	0.0050
27	1	3	1	4	0.0000
28	1	3	2	2	0.0000
29	1	3	2	3	0.0000
30	1	3	2	4	0.0050
31	1	3	3	2	0.0000
32	1	3	3	3	0.0000
33	1	3	3	4	0.0100
34	1	3	4	2	0.0000
35	1	3	4	3	0.0050
36	1	3	4	4	0.0050
37	1	4	1	2	0.0000
38	1	4	1	3	0.0000
39	1	4	1	4	0.0100
40	1	4	2	2	0.0120
41	1	4	2	3	0.0100
42	1	4	2	4	0.0000
43	1	4	3	2	0.0050
44	1	4	3	3	0.0000
45	1	4	3	4	0.0150
46	1	4	4	2	0.0050
47	1	4	4	3	0.0000
48	1	4	4	4	0.0345
49	1	5	1	2	0.0000
50	1	5	1	3	0.0000
51	1	5	1	4	0.0100
52	1	5	2	2	0.0024
53	1	5	2	3	0.0050
54	1	5	2	4	0.0100
55	1	5	3	2	0.0000
56	1	5	3	3	0.0050
57	1	5	3	4	0.0100
58	1	5	4	2	0.0000
59	1	5	4	3	0.0000
60	1	5	4	4	0.0100
61	1	6	1	2	0.0000
62	1	6	1	3	0.0050
63	1	6	1	4	0.0050
64	1	6	2	2	0.0050
65	1	6	2	3	0.0000
66	1	6	2	4	0.0100
67	1	6	3	2	0.0000
68	1	6	3	3	0.0050
69	1	6	3	4	0.0000
70	1	6	4	2	0.0000
71	1	6	4	3	0.0050
72	1	6	4	4	0.0050
73	1	7	1	2	0.0000
74	1	7	1	3	0.0050

OBS	G	S	C	H	P_ERROR
75	1	7	1	4	0.000
76	1	7	2	2	0.000
77	1	7	2	3	0.000
78	1	7	2	4	0.000
79	1	7	3	2	0.000
80	1	7	3	3	0.000
81	1	7	3	4	0.005
82	1	7	4	2	0.010
83	1	7	4	3	0.000
84	1	7	4	4	0.025
85	1	8	1	2	0.000
86	1	8	1	3	0.000
87	1	8	1	4	0.000
88	1	8	2	2	0.000
89	1	8	2	3	0.000
90	1	8	2	4	0.000
91	1	8	3	2	0.033
92	1	8	3	3	0.000
93	1	8	3	4	0.005
94	1	8	4	2	0.000
95	1	8	4	3	0.000
96	1	8	4	4	0.000
97	1	9	1	2	0.005
98	1	9	1	3	0.000
99	1	9	1	4	0.005
100	1	9	2	2	0.000
101	1	9	2	3	0.000
102	1	9	2	4	0.005
103	1	9	3	2	0.000
104	1	9	3	3	0.000
105	1	9	3	4	0.010
106	1	9	4	2	0.000
107	1	9	4	3	0.000
108	1	9	4	4	0.005
109	1	10	1	2	0.000
110	1	10	1	3	0.005
111	1	10	1	4	0.005
112	1	10	2	2	0.000
113	1	10	2	3	0.005
114	1	10	2	4	0.020
115	1	10	3	2	0.000
116	1	10	3	3	0.005
117	1	10	3	4	0.000
118	1	10	4	2	0.000
119	1	10	4	3	0.000
120	1	10	4	4	0.010
121	2	1	1	2	0.005
122	2	1	1	3	0.000
123	2	1	1	4	0.010
124	2	1	2	2	0.000
125	2	1	2	3	0.000
126	2	1	2	4	0.000
127	2	1	3	2	0.000
128	2	1	3	3	0.000
129	2	1	3	4	0.005
130	2	1	4	2	0.000
131	2	1	4	3	0.000
132	2	1	4	4	0.015
133	2	2	1	2	0.000
134	2	2	1	3	0.005
135	2	2	1	4	0.000
136	2	2	2	2	0.005
137	2	2	2	3	0.000
138	2	2	2	4	0.005
139	2	2	3	2	0.000
140	2	2	3	3	0.000
141	2	2	3	4	0.010
142	2	2	4	2	0.000
143	2	2	4	3	0.000
144	2	2	4	4	0.000
145	2	3	1	2	0.000
146	2	3	1	3	0.000
147	2	3	1	4	0.000
148	2	3	2	2	0.000

OBS	O	S	C	H	P_ERROR
149	2	3	2	3	0.0050
150	2	3	2	4	0.0050
151	2	3	3	2	0.0000
152	2	3	3	3	0.0000
153	2	3	3	4	0.0000
154	2	3	4	2	0.0000
155	2	3	4	3	0.0000
156	2	3	4	4	0.0050
157	2	4	1	2	0.0000
158	2	4	1	3	0.0000
159	2	4	1	4	0.0100
160	2	4	2	2	0.0000
161	2	4	2	3	0.0050
162	2	4	2	4	0.0100
163	2	4	3	2	0.0000
164	2	4	3	3	0.0000
165	2	4	3	4	0.0150
166	2	4	4	2	0.0000
167	2	4	4	3	0.0000
168	2	4	4	4	0.0050
169	2	5	1	2	0.0050
170	2	5	1	3	0.0000
171	2	5	1	4	0.0150
172	2	5	2	2	0.0100
173	2	5	2	3	0.0000
174	2	5	2	4	0.0000
175	2	5	3	2	0.0000
176	2	5	3	3	0.0050
177	2	5	3	4	0.0050
178	2	5	4	2	0.0100
179	2	5	4	3	0.0050
180	2	5	4	4	0.0000
181	2	6	1	2	0.0000
182	2	6	1	3	0.0050
183	2	6	1	4	0.0150
184	2	6	2	2	0.0000
185	2	6	2	3	0.0000
186	2	6	2	4	0.0100
187	2	6	3	2	0.0000
188	2	6	3	3	0.0000
189	2	6	3	4	0.0075
190	2	6	4	2	0.0000
191	2	6	4	3	0.0000
192	2	6	4	4	0.0050
193	2	7	1	2	0.0000
194	2	7	1	3	0.0050
195	2	7	1	4	0.0200
196	2	7	2	2	0.0000
197	2	7	2	3	0.0000
198	2	7	2	4	0.0000
199	2	7	3	2	0.0000
200	2	7	3	3	0.0050
201	2	7	3	4	0.0000
202	2	7	4	2	0.0000
203	2	7	4	3	0.0000
204	2	7	4	4	0.0000
205	2	8	1	2	0.0000
206	2	8	1	3	0.0000
207	2	8	1	4	0.0100
208	2	8	2	2	0.0000
209	2	8	2	3	0.0000
210	2	8	2	4	0.0050
211	2	8	3	2	0.0000
212	2	8	3	3	0.0000
213	2	8	3	4	0.0000
214	2	8	4	2	0.0000
215	2	8	4	3	0.0000
216	2	8	4	4	0.0050
217	2	9	1	2	0.0000
218	2	9	1	3	0.0000
219	2	9	1	4	0.0050
220	2	9	2	2	0.0000
221	2	9	2	3	0.0100
222	2	9	2	4	0.0050

****** PERCENTAGE OF PERFORMANCE ERRORS ****** 12:18 FRIDAY, JUNE 9, 1978 4

OBS	G	S	C	H	P_ERROR
223	2	9	3	2	0.000
224	2	9	3	3	0.000
225	2	9	3	4	0.000
226	2	9	4	2	0.000
227	2	9	4	3	0.000
228	2	9	4	4	0.000
229	2	10	1	2	0.005
230	2	10	1	3	0.000
231	2	10	1	4	0.000
232	2	10	2	2	0.000
233	2	10	2	3	0.000
234	2	10	2	4	0.010
235	2	10	3	2	0.000
236	2	10	3	3	0.005
237	2	10	3	4	0.000
238	2	10	4	2	0.005
239	2	10	4	3	0.005
240	2	10	4	4	0.005

APPENDIX D

- Computer programmes and results

NOTE: THE JOB PLUT2 HAS BEEN RUN UNDER RELEASE 76.6 OF SAS AT THE UNIVERSITY OF WINDSOR.

```
  DATA  MAIN;
LP1:
   INPUT  GR 73 SUB 75-76 COND 78-79  @ ;
   RETAIN  GROUP  SUBJ_NO  COND_NO  DISTANC ;
   IF GR=.  THEN GO TO LP2 ;
   GROUP = GR ;
   SUBJ_NO = SUB ;
   COND_NO = COND ;
   INPUT / (D1-D15)(@1 6. 3. 5. 6. 3. 5. 6. 3. 5. 6. 3. 5. 6. 3. 5. ) ;
   GO TO LP3 ;
LP2:
   INPUT   (D1-D15)(@1 6. 3. 5. 6. 3. 5. 6. 3. 5. 6. 3. 5. 6. 3. 5. ) ;
LP3:
   DROP  D1-D15 ;
   IF   D2 >12 AND D2 <16 OR D2 =0  THEN D=7  ;
   IF   D2>8 AND D2<13  THEN D=10 ;
   IF   D2>4 AND D2<9  THEN D=13 ;
   IF   D2>0 AND D2<5  THEN D=16 ;
   IF D1=. OR D2=. OR D3=. THEN DELETE;
   DISTANC = D ;
   PERT = D1; DECT = D3 ; MOVT = D1-D3 ; HOLN = D2 ;  OUTPUT ;
LP4:
   IF   D5 >12 AND D5 <16 OR D5 =0  THEN D=7 ;
   IF   D5>8 AND D5<13  THEN D=10 ;
   IF   D5>4 AND D5<9  THEN D=13 ;
   IF   D5>0 AND D5<5  THEN D=16 ;
   IF D4 = . OR D5 = . OR D6 = . THEN DELETE;
   DISTANC = D ;
   PERT = D4 ; DECT = D6 ; MOVT = D4-D6 ; HOLN = D5 ; OUTPUT ;
LP5:
   IF   D8 >12 AND D8 <16 OR D8 =0  THEN D=7 ;
   IF   D8>8 AND D8<13  THEN D=10 ;
   IF   D8>4 AND D8<9  THEN D=13 ;
   IF   D8>0 AND D8<5  THEN D=16 ;
   IF D7 = . OR D8 = . OR D9 = . THEN DELETE;
   DISTANC = D ;
   PERT = D7 ; DECT = D9 ; MOVT = D7-D9 ; HOLN = D8 ; OUTPUT ;
LP6:
   IF   D11>12 AND D11<16 OR D11=0  THEN D=7 ;
   IF   D11>8 AND D11<13  THEN D=10 ;
   IF   D11>4 AND D11<9  THEN D=13 ;
   IF   D11>0 AND D11<5  THEN D=16 ;
   IF D10 = . OR D11 = . OR D12 = . THEN DELETE;
   DISTANC = D ;
   PERT = D10 ; DECT = D12 ; MOVT = D10-D12 ; HOLN = D11 ; OUTPUT ;
LP7 :
   IF   D14>12 AND D14<16 OR D14=0  THEN D=7 ;
   IF   D14>8 AND D14<13  THEN D=10 ;
   IF   D14>4 AND D14<9  THEN D=13 ;
   IF   D14>0 AND D14<5  THEN D=16 ;
   IF D13 = . OR D14 = . OR D15 = . THEN DELETE;
   DISTANC = D ;
   PERT = D13 ; DECT = D15 ; MOVT = D13-D15 ; HOLN = D14 ; OUTPUT ;
   GO TO LP1 ;
   KEEP  GROUP SUBJ_NO COND_NO PERT DECT MOVT  DISTANC  ;
   CARDS;
```

```
2                              S T A T I S T I C A L   A N A L Y S I S   S Y S T E M             13:58 FRIDAY, MAY 26, 1978

           PROC SORT DATA= MAIN ;
           BY GROUP  SUBJ_NO  COND_NO  DISTANC ;

NOTE: SORT IS NOT SUPPORTED BY THE AUTHOR OR BY SAS.
NOTE: DATA SET WORK.MAIN HAS 5 OBSERVATIONS AND 7 VARIABLES. 121 OBS/TRK.
NOTE: THE PROCEDURE SORT USED 1.59 SECONDS AND 106K.

           PROC  MEANS  DATA=MAIN  NOPRINT ;
           VAR   PERT  DECT  MOVT ; BY  GROUP SUBJ_NO COND_NO  DISTANC ;
           OUTPUT  OUT=STATS  MEAN= M1 M2 M3  STD= S1 S2 S3 ;

NOTE: DATA SET WORK.STATS HAS 4 OBSERVATIONS AND 10 VARIABLES. 86 OBS/TRK.
NOTE: THE PROCEDURE MEANS USED 0.31 SECONDS AND 116K.

           DATA MAIN ;
           MERGE  MAIN  STATS ;
           BY  GROUP  SUBJ_NO  COND_NO  DISTANC ;
           RETAIN  TOBS  0 ;
           ERPT1 = M1 + 3 * S1 ;  ERPT2 = M1 - 3 * S1 ;
           ERDT1 = M2 + 3 * S2 ;  ERDT2 = M2 - 3 * S2 ;
           ERMT1 = M3 + 3 * S3 ;  ERMT2 = M3 - 3 * S3 ;
           IF FIRST.DISTANC = 0  AND  LAST.DISTANC = 1  THEN GO TO ENDD ;
           IF   PERT ¬> ERPT1  AND  PERT ¬< ERPT2  AND
                DECT ¬>ERDT1  AND  DECT ¬< ERDT2  AND
                MOVT ¬> ERMT1  AND  MOVT ¬< ERMT2  THEN TOBS = TOBS + 1 ;
           IF   PERT > ERPT1  OR  PERT < ERPT2  OR
                DECT > ERDT1  OR  DECT < ERDT2  OR
                MOVT > ERMT1  OR  MOVT < ERMT2  THEN  DELETE ;
           RETURN ;
         ENDD:
           TOBS = 0 ;
           KEEP PERT DECT MOVT GROUP SUBJ_NO COND_NO DISTANC TOBS ;
```

```
        PROC ANOVA  DATA=MFINAL ;
        CLASSES  G S C H D ;
        MODEL  MOV_TIME= G S(G) C H D C*H C*D H*D G*C G*H G*D
                         S*C(G) S*H(G) S*D(G)
                         G*C*H G*C*D G*H*D C*H*D
                         S*C*H(G) S*C*D(G) S*H*D(G)
                          G*C*H*D S*C*H*D(G)        ;
        TEST  H=G      E=S(G)  ;
        TEST  H=C  G*C  E=S*C(G) ;
        TEST  H=H  G*H    E=S*H(G) ;
        TEST  H=D G*D  E=S*D(G) ;
        TEST  H=C*H  G*C*H  E=S*C*H(G) ;
        TEST  H=C*D  G*C*D  E=S*C*D(G) ;
        TEST H= H*D  C*H*D  E= S*H*D(G) ;
        TEST  H= C*H*D  G*C*H*D  E= S*C*H*D(G) ;
        MEANS  G H C D G*H G*C G*D C*H C*D H*D ;
        TITLE  ***   ANOVA FOR THE SECOND MODEL   *** ;
        TITLE2 ************************************************************ ;
        TITLE3 *  DEPENDENT VAR. : MOVEMENT TIME  :  MOV_TIME      *;
        TITLE4 *  INDEPEND.  VAR.  :     G  : AGE                  * ;
        TITLE5 *                         S  : SUBJECTS             *;
        TITLE6 *                         C  : CLEARANCE            *;
        TITLE7 *                         H  : INFORMATION LOAD     * ;
        TITLE8 *                         D  : DISTANCE             * ;
        TITLE9 *******************************************************;

NOTE: THE PROCEDURE ANOVA USED 32.44 SECONDS AND 224K AND PRINTED PAGES 6 TO 10.

        DATA INDIF;  SET FINAL;
        IF  C=1  AND  D=7  THEN I=1 ;
        IF  C=1  AND  D=10 THEN I=2 ;
        IF  C=1  AND  D=13 THEN I=3 ;
        IF  C=1  AND  D=16 THEN I=4 ;
        IF  C=2  AND  D=7  THEN I=5 ;
        IF  C=2  AND  D=10 THEN I=6 ;
        IF  C=2  AND  D=13 THEN I=7 ;
        IF  C=2  AND  D=16 THEN I=8 ;
        IF  C=3  AND  D=7  THEN I=9 ;
        IF  C=3  AND  D=10 THEN I=10;
        IF  C=3  AND  D=13 THEN I=11;
        IF  C=3  AND  D=16 THEN I=12;
        IF  C=4  AND  D=7  THEN I=13;
        IF  C=4  AND  D=10 THEN I=14;
        IF  C=4  AND  D=13 THEN I=15  ;
        IF  C=4  AND  D=16 THEN I=16  ;

NOTE: DATA SET WORK.INDIF HAS 39400 OBSERVATIONS AND 15 VARIABLES.
NOTE: THE DATA STATEMENT USED 46.18 SECONDS AND 104K.

        PROC SORT  DATA = INDIF ;
        BY  G S H I ;

NOTE: DATA SET WORK.INDIF HAS 39400 OBSERVATIONS AND 15 VARIABLES.
NOTE: THE PROCEDURE SORT USED 57.79 SECONDS AND 104K.

        PROC  MEANS  DATA=INDIF NOPRINT ;
        VAR  DECT  MOVT ;
        BY  G S H I ;
        OUTPUT  OUT=G_I  MEAN = DEC_TIME  MOV_TIME ;

NOTE: DATA SET WORK.G_I HAS 500 OBSERVATIONS AND 6 VARIABLES.
NOTE: THE PROCEDURE MEANS USED 45.31 SECONDS AND 114K.

        PROC ANOVA  DATA=G_I ;
        CLASSES  G S H I ;
        MODEL  DEC_TIME = G S(G) H I G*H G*I H*I
                          S*H(G) S*I(G) S*H*I(G) G*H*I   ;
        TEST  H=G  E=S(G) ;
        TEST  H=H  G*H  E=S*H(G) ;
        TEST  H=I  G*I  E=S*I(G) ;
        TEST  H=H*I  G*H*I  E=S*H*I(G) ;
        MEANS  I  G*I H*I ;
```

```
NOTE: DATA SET WORK.MFINAL HAS 960 OBSERVATIONS AND 7 VARIABLES.
NOTE: THE DATA STATEMENT USED 0.93 SECONDS AND 104K.

        PROC ANOVA  DATA=MFINAL ;
        CLASSES  G S C H D ;
        MODEL  DEC_TIME= G S(G) C H D C*H C*D H*D G*C G*H G*D
                      S*C(G) S*H(G) S*D(G)
                    G*C*H G*C*D G*H*D C*H*D
                    S*C*H(G) S*C*D(G) S*H*D(G)
                      G*C*H*D S*C*H*D(G)    ;
        TEST  H=S      E=S(G)  ;
        TEST  H=C  G*C  E=S*C(G) ;
        TEST  H=H  G*H    E=S*H(G) ;
        TEST  H=D G*D  E=S*D(G) ;
        TEST  H=C*H  G*C*H  E=S*C*H(G) ;
        TEST  H=C*D  G*C*D  E=S*C*D(G) ;
        TEST H= H*D  G*H*D  E= S*H*D(G) ;
        TEST  H= C*H*D  G*C*H*D  E= S*C*H*D(G) ;
        MEANS  G H C D G*H G*C G*D C*H C*D H*D ;
        TITLE ***   ANOVA FOR THE FIRST MODEL    *** ;
        TITLE2 ******************************************************** ;
        TITLE3 *  DEPENDENT VAR. : DECISION TIME  :  DEC_TIME     *;
        TITLE4 *  INDEPEND.  VAR.  :     G  : AGE                 * ;
        TITLE5 *                         S  : SUBJECTS            *;
        TITLE6 *                         C  : CLEARANCE           *;
        TITLE7 *                         H  : INFORMATION LOAD    * ;
        TITLE8 *                         D  : DISTANCE            * ;
        TITLE9 ******************************************************;

NOTE: THE PROCEDURE ANOVA USED 31.41 SECONDS AND 204K AND PRINTED PAGES 1 TO 5.

        PROC  MEANS  DATA=FINAL  NOPRINT ;
        VAR  MOVT ;  BY  G S C H D ;
        OUTPUT OUT=MFINAL  MEAN=MOV_TIME ;

NOTE: DATA SET WORK.MFINAL HAS 960 OBSERVATIONS AND 6 VARIABLES.
NOTE: THE PROCEDURE MEANS USED 33.94 SECONDS AND 112K.
```

```
      ***   ANOVA FOR THE FIRST MODEL   ***                        22:18 FRIDAY, APRIL 21, 1978    1
*************************************************************
    *  DEPENDENT VAR. : DECISION TIME  :  DEC_TIME     *
    *  INDEPEND.  VAR.  :        G  : AGE              *
    *                            S  : SUBJECTS         *
    *                            C  : CLEARANCE        *
    *                            H  : INFORMATION LOAD *
    *                            D  : DISTANCE         *
    ****************************************************
```

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
G	2	1 2
S	10	1 2 3 4 5 6 7 8 9 10
C	4	1 2 3 4
H	3	2 3 4
D	4	7 10 13 16

NUMBER OF OBSERVATIONS IN DATA SET = 960

*** ANOVA FOR THE FIRST MODEL *** 22:18 FRIDAY, APRIL 21, 1978 2

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**************************************************************
*  DEPENDENT VAR. : DECISION TIME   :  DEC_TIME             *
*  INDEPEND.  VAR. :       G  : AGE                           *
*                          S  : SUBJECTS                      *
*                          C  : CLEARANCE                     *
*                          H  : INFORMATION_LOAD              *
*                          D  : DISTANCE                      *
**************************************************************
```

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DEC_TIME

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	959	44134575.82053141	46021.45550212	99999.99	0.0000	1.000000	0.0000
ERROR	0	0.00000000	0.00000000		STD DEV		DEC_TIME MEAN
CORRECTED TOTAL	959	44134575.82053135			0.00000000		562.61606771

SOURCE	DF	ANOVA SS	F VALUE	PR > F
G	1	17511724.28143754	.	.
S(G)	18	10502552.97643322	.	.
C	3	112651.61358673	.	.
H	2	9781184.60092489	.	.
D	3	39517.01621276	.	.
C*H	6	116834.97274381	.	.
C*D	9	4153.31118771	.	.
H*D	6	52590.64549343	.	.
G*C	3	22959.42625773	.	.
G*H	2	449613.59241575	.	.
G*D	3	9603.43506509	.	.
S*C(G)	54	1582234.03871441	.	.
S*H(G)	36	1321610.77938335	.	.
S*D(G)	54	169324.30342264	.	.
G*C*H	6	129344.82264349	.	.
G*C*D	9	3167.95282173	.	.
G*H*D	6	8941.46025997	.	.
C*H*D	18	17686.11301438	.	.
S*C*H(G)	108	1726261.44974011	.	.
S*C*D(G)	162	175334.24509138	.	.
S*H*D(G)	108	163203.55334491	.	.
G*C*H*D	18	21435.49809515	.	.
S*C*H*D(G)	324	277034.16678023	.	.

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
G	1	17511724.28143754	30.01	0.0001

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*C(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
C	3	112651.61358673	1.28	0.2896
G*C	3	22959.42625773	0.26	0.8514

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*H(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
H	2	9781184.60092489	133.22	0.0001
G*H	2	449613.59241575	6.00	0.0055

```
***   ANOVA FOR THE FIRST MODEL   ***
**************************************************************
*  DEPENDENT VAR. : DECISION TIME   :  DEC_TIME            *
*  INDEPEND.  VAR.  :          G  : AGE                     *
*                              S  : SUBJECTS                *
*                              C  : CLEARANCE               *
*                              H  : INFORMATION LOAD        *
*                              D  : DISTANCE                *
**************************************************************
```

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DEC_TIME

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*D(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
D	3	32517.01621276	7.05	0.0005
S*D	3	9693.43526599	1.71	0.1734

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*C*H(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
C*H	6	116833.97274381	1.22	0.3026
S*C*H	6	131843.32264347	1.46	0.1995

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*C*D(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
C*D	9	4153.91118771	0.43	0.9200
S*C*D	9	3167.95282173	0.32	0.9654

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*H*D(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
H*D	6	52599.64548343	5.73	0.0001
S*H*D	6	8343.46025997	0.97	0.4462

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*C*H*D(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
C*H*D	18	17686.11301458	1.15	0.3032
S*C*H*D	18	21435.41819515	1.39	0.1324

```
***   ANOVA FOR THE SECOND MODEL   ***
*******************************************************************
  *  DEPENDENT VAR. : MOVEMENT TIME  :  MOV_TIME         *
  *  INDEPEND.  VAR.  :     G  : AGE                       *
  *                         S  : SUBJECTS                  *
  *                         C  : CLEARANCE                 *
  *                         H  : INFORMATION LOAD          *
  *                         D  : DISTANCE                  *
  *********************************************************
```

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
G	2	1 2
S	10	1 2 3 4 5 6 7 8 9 10
C	4	1 2 3 4
H	3	2 3 4
D	4	7 10 13 16

NUMBER OF OBSERVATIONS IN DATA SET = 960

*** ANOVA FOR THE SECOND MODEL *** 22:18 FRIDAY, APRIL 21, 1978 7

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***************************************************************
*  DEPENDENT VAR. : MOVEMENT TIME  :  MOV_TIME                *
*  INDEPEND.  VAR.  :     G  :  AGE                           *
*                         S  :  SUBJECTS                      *
*                         C  :  CLEARANCE                     *
*                         H  :  INFORMATION LOAD              *
*                         D  :  DISTANCE                      *
***************************************************************
```

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: MOV_TIME

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	959	23814534.99772557	24836.84574737	99999.99	0.0000	1.000000	0.0000
ERROR	0	0.00000000	0.00000000		STD DEV		MOV_TIME MEAN
CORRECTED TOTAL	959	23814534.99772557			0.00000000		750.38039062

SOURCE	DF	ANOVA SS	F VALUE	PR > F
G	1	5192493.55770695	.	.
S(G)	18	7337511.72115368	.	.
C	3	3162359.40364492	.	.
H	2	69435.36668503	.	.
D	3	3742171.01610327	.	.
C*H	6	33858.21524167	.	.
C*D	9	31655.77689391	.	.
H*D	6	138578.07125217	.	.
G*C	3	70154.19105602	.	.
G*H	2	45824.21301830	.	.
G*D	3	2214.57680607	.	.
S*C(G)	54	1078940.57604063	.	.
S*H(G)	36	336227.52438468	.	.
S*D(G)	54	449352.54922891	.	.
G*C*H	6	54152.18533850	.	.
G*C*D	9	9635.47905178	.	.
G*H*D	6	13949.52136358	.	.
C*H*D	18	36463.79407066	.	.
S*C*H(G)	108	994793.00199546	.	.
S*C*D(G)	162	309944.05137924	.	.
S*H*D(G)	108	254146.79880894	.	.
G*C*H*D	18	27676.79677349	.	.
S*C*H*D(G)	324	445647.15647191	.	.

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
G	1	5192493.55770695	12.74	0.0022

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*C(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
C	3	3162359.40364492	52.76	0.0001
G*C	3	70154.19105602	1.17	0.3297

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*H(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
H	2	69435.36668503	3.72	0.0341
G*H	2	45824.21301830	2.45	0.1003

*** ANOVA FOR THE SECOND MODEL ***

```
**************************************************************
*  DEPENDENT VAR. : MOVEMENT TIME  :  MOV_TIME              *
*  INDEPEND.  VAR.  :     G  : AGE                           *
*                         S  : SUBJECTS                      *
*                         C  : CLEARANCE                     *
*                         H  : INFORMATION LOAD              *
*                         D  : DISTANCE                      *
**************************************************************
```

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: MOV_TIME

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*D(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
D	3	3742171.01610327	152.97	0.0001
G*D	3	2214.57680607	0.09	0.9599

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*C*H(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
C*H	6	33868.21524167	0.61	0.7205
G*C*H	6	54152.19533850	0.98	0.4426

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*C*D(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
C*D	9	33655.77689391	2.01	0.0433
G*C*D	9	9636.47065198	0.58	0.8161

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*H*D(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
H*D	6	138973.07125217	9.84	0.0001
G*H*D	6	10943.57135958	0.78	0.5909

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*C*H*D(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
C*H*D	18	35469.79407066	1.47	0.0975
G*C*H*D	18	27676.79677349	1.12	0.3329

```
***   ANOVA FOR THE THIRD MODEL   ***                                  22:18 FRIDAY, APRIL 21, 1978   11
**************************************************************
    * DEPENDENT VAR. : DECISION TIME  :  DEC_TIME        *
    * INDEPEND. VAR.  :         G : AGE                  *
    *                           S : SUBJECTS             *
    *                           I :  INDEX OF DIFFICULTY *
    *                           H : INFORMATION LOAD     *

    ***************************************************

              ANALYSIS OF VARIANCE PROCEDURE

                 CLASS LEVEL INFORMATION

CLASS     LEVELS     VALUES

G            2       1 2

S           10       1 2 3 4 5 6 7 8 9 10

H            3       2 3 4

I           16       1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

       NUMBER OF OBSERVATIONS IN DATA SET = 960
```

*** ANOVA FOR THE THIRD MODEL *** 22:18 FRIDAY, APRIL 21, 1978 12

DEPENDENT VAR. : DECISION TIME : DEC_TIME
INDEPEND. VAR. : G : AGE
S : SUBJECTS
I : INDEX OF DIFFICULTY
H : INFORMATION LOAD

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DEC_TIME

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	559	44134575.82653159	40021.45550212	99999.99	0.0000	1.000000	0.0000
ERROR	0	0.00000000	0.00000000		STD DEV		DEC_TIME MEAN
CORRECTED TOTAL	559	44134575.82653159			0.00000000		562.61606771

SOURCE	DF	ANOVA SS	F VALUE	PR > F
G	1	17511724.28140754	.	.
S(G)	18	10562552.97693328	.	.
H	2	9781184.69692499	.	.
I	15	155327.74108726	.	.
G*H	2	440613.59241575	.	.
G*I	15	35730.81414449	.	.
H*I	30	167110.73124176	.	.
S*H(G)	36	1321610.77938324	.	.
S*I(G)	270	1659009.35222816	.	.
S*H*I(G)	540	2108496.16986443	.	.
G*H*I	30	173223.78100073	.	.

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
G	1	17511724.28140754	30.01	0.0001

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*H(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
H	2	9781184.60692489	133.22	0.0001
G*H	2	440613.59241575	6.00	0.0056

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*I(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
I	15	156327.74108726	1.51	0.0994
G*I	15	35730.81414449	0.35	0.9823

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*H*I(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
H*I	30	167110.73124176	1.55	0.0322
G*H*I	30	173223.78100073	1.41	0.0737

*** ANOVA FOR THE FOURTH MODEL *** 22:18 FRIDAY, APRIL 21, 1978 15

```
***********************************************************
*  DEPENDENT VAR. : MOVEMENT TIME  :  MOV_TIME            *
*  INDEPEND.  VAR.  :          G  :  AGE                  *
*                              S  :  SUBJECTS             *
*                              I  :  INDEX OF DIFFICULTY  *
*                              H  :  INFORMATION LOAD     *
*                                                         *
***********************************************************
```

ANALYSIS OF VARIANCE PROCEDURE

CLASS LEVEL INFORMATION

CLASS	LEVELS	VALUES
G	2	1 2
S	10	1 2 3 4 5 6 7 8 9 10
H	3	2 3 4
I	16	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

NUMBER OF OBSERVATIONS IN DATA SET = 960

*** ANOVA FOR THE FOURTH MODEL *** 22:18 FRIDAY, APRIL 21, 1978 16

```
***********************************************************
*  DEPENDENT VAR. : MOVEMENT TIME  :  MOV_TIME            *
*  INDEPEND.  VAR.  :          G  :  AGE                  *
*                              S  :  SUBJECTS             *
*                              I  :  INDEX OF DIFFICULTY  *
*                              H  :  INFORMATION LOAD     *
*                                                         *
***********************************************************
```

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: MOV_TIME

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	959	23818534.90772557	24836.84574737	99999.99	0.0000	1.000000	0.0000
ERROR	0	0.00000000	0.00000000		STD DEV		MOV_TIME MEAN
CORRECTED TOTAL	959	23818534.90772557			0.00000000		750.38039062

SOURCE	DF	ANOVA SS	F VALUE	PR > F
G	1	5192493.95770689	.	.
S(G)	18	7337511.72115369	.	.
H	2	69435.36068497	.	.
I	15	6934185.19604294	.	.
G*H	2	43824.21301836	.	.
G*I	15	82007.22851413	.	.
H*I	30	209247.94056436	.	.
S*H(G)	36	336227.52438468	.	.
S*I(G)	270	1829241.16923488	.	.
S*H*I(G)	540	1694583.94727582	.	.
G*H*I	30	92779.50348157	.	.

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
G	1	5192493.95776689	12.74	0.0022

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*H(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
H	2	69435.36668497	3.72	0.0341
G*H	2	45824.21101836	2.45	0.1003

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*I(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
I	15	6938186.19664204	58.61	0.0001
G*I	15	82009.22851413	0.81	0.6659

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*H*I(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
H*I	30	209247.08956456	2.22	0.0003
G*H*I	30	92778.50348157	0.99	0.4932

```
1282        MERGE  FIRST  SAME  ;
1283        BY  GROUP  SUBJ_NO  COND_NO  DISTANC  ;
1284        D=DISTANC ;
1285        S = SUBJ_NO ;
1286        G= GROUP ;
1287        IF   COND_NO=1 OR COND_NO=4 OR COND_NO=7 OR COND_NO=10 THEN  H=2;
1288        IF   COND_NO=2 OR COND_NO=5 OR COND_NO=8 OR COND_NO=11  THEN  H=3 ;
1289        IF   COND_NO=3 OR COND_NO=6 OR COND_NO =9 OR COND_NO=12  THEN  H=4 ;
1290        IF   COND_NO=1 OR COND_NO=2 OR COND_NO=3  THEN  C= 1 ;
1291        IF   COND_NO=4 OR COND_NO = 5 OR COND_NO=6  THEN  C= 2 ;
1292        IF   COND_NO=7 OR COND_NO=8 OR COND_NO=9  THEN  C = 3 ;
1293        IF   COND_NO=10 OR COND_NO=11 OR COND_NO=12  THEN  C= 4 ;
1294

NOTE: DATA SET WORK.FINAL HAS 38400 OBSERVATIONS AND 14 VARIABLES. 62 OBS/TRK.
NOTE: THE DATA STATEMENT USED 79.38 SECONDS AND 104K.

1294        DATA INDIF;  SET FINAL;
1295        IF  C=1  AND  D=7   THEN I=4.222 ;
1296        IF  C=1  AND  D=10  THEN I=4.737 ;
1297        IF  C=1  AND  D=13  THEN I=5.115 ;
1298        IF  C=1  AND  D=16  THEN I=5.415 ;
1299        IF  C=2  AND  D=7   THEN I=5.807 ;
1300        IF  C=2  AND  D=10  THEN I=6.322 ;
1301        IF  C=2  AND  D=13  THEN I=6.7 ;
1302        IF  C=2  AND  D=16  THEN I=7 ;
1303        IF  C=3  AND  D=7   THEN I=7.796 ;
1304        IF  C=3  AND  D=10  THEN I=8.31 ;
1305        IF  C=3  AND  D=13  THEN I=8.689 ;
1306        IF  C=3  AND  D=16  THEN I=8.989 ;
1307        IF  C=4  AND  D=7   THEN I=10.773 ;
1308        IF  C=4  AND  D=10  THEN I=11.288 ;
1309        IF  C=4  AND  D=13  THEN I=11.666;
1310        IF  C=4  AND  D=16  THEN I=11.966 ;
1311

NOTE: DATA SET WORK.INDIF HAS 38400 OBSERVATIONS AND 15 VARIABLES. 58 OBS/TRK.
NOTE: THE DATA STATEMENT USED 45.11 SECONDS AND 104K.

1311        PROC SORT DATA =  INDIF;  BY G I   ;
1312

NOTE: SORT IS NOT SUPPORTED BY THE AUTHOR OR BY SAS.
NOTE: DATA SET WORK.INDIF HAS 38400 OBSERVATIONS AND 15 VARIABLES. 58 OBS/TRK.
NOTE: THE PROCEDURE SORT USED 57.58 SECONDS AND 110K.

1312        PROC  MEANS  DATA =  INDIF  NOPRINT;
1313      VAR  MOVT;  BY G I;
1314        OUTPUT  OUT =  G_I   MEAN = MOV_TIME;
1315

NOTE: DATA SET WORK.G_I HAS 32 OBSERVATIONS AND 3 VARIABLES. 260 OBS/TRK.
NOTE: THE PROCEDURE MEANS USED 23.21 SECONDS AND 120K.

1315        PROC  GLM  DATA=G_I ;
1316        MODEL  MOV_TIME=I;
1317        TITLE ****  ALL SUBJECT  **** ;
1318

NOTE: THE PROCEDURE GLM USED 0.94 SECONDS AND 154K AND PRINTED PAGE 1.

1318        DATA  FITT  ; SET  G_I ;
1319        IF  G=2  THEN DELETE ;
1320

NOTE: DATA SET WORK.FITT HAS 16 OBSERVATIONS AND 3 VARIABLES. 260 OBS/TRK.
NOTE: THE DATA STATEMENT USED 0.26 SECONDS AND 104K.

1320        PROC  GLM  DATA=FITT ;
1321        MODEL  MOV_TIME=I ;
1322        TITLE ****  YOUNG GROUP  **** ;
1323

NOTE: THE PROCEDURE GLM USED 0.68 SECONDS AND 154K AND PRINTED PAGE 2.

1323        PROC PLOT  DATA= FITT ;
```

```
1324          PLOT  MOV_TIME * I ;
1325

NOTE: THE PROCEDURE PLOT USED 0.89 SECONDS AND 122K AND PRINTED PAGE 3.

1325          DATA  FITT  ; SET  G_I ;
1326          IF  G=1  THEN DELETE ;
1327

NOTE: DATA SET WORK.FITT HAS 16 OBSERVATIONS AND 3 VARIABLES. 260 OBS/TRK.
NOTE: THE DATA STATEMENT USED 0.23 SECONDS AND 104K.

1327          PROC  GLM  DATA=FITT ;
1328          MODEL  MOV_TIME=I ;
1329          TITLE ****  OLD GROUP  **** ;
1330

NOTE: THE PROCEDURE GLM USED 0.93 SECONDS AND 154K AND PRINTED PAGE 4.

1330          PROC PLOT  DATA =FITT ;
1331          PLOT  MOV_TIME * I ;
1332

NOTE: THE PROCEDURE PLOT USED 0.91 SECONDS AND 122K AND PRINTED PAGE 5.

1332          DATA FITT;  SET G_I;
1333          IF  I<5.5  THEN DELETE ;
1334

NOTE: DATA SET WORK.FITT HAS 24 OBSERVATIONS AND 3 VARIABLES. 260 OBS/TRK.
NOTE: THE DATA STATEMENT USED 0.21 SECONDS AND 104K.

1334          PROC GLM  DATA =  FITT;
1335           MODEL  MOV_TIME = I;
1336          TITLE *****  ALL SUBJECTS  ****;
1337

NOTE: THE PROCEDURE GLM USED 0.96 SECONDS AND 154K AND PRINTED PAGE 6.

1337           DATA FITT;  SET G_I;
1338          IF I<5.5 OR G=2  THEN DELETE ;
1339          IF I < 5 OR G = 2  THEN DELETE;
1340

NOTE: DATA SET WORK.FITT HAS 12 OBSERVATIONS AND 3 VARIABLES. 260 OBS/TRK.
NOTE: THE DATA STATEMENT USED 0.26 SECONDS AND 104K.

1340          PROC GLM  DATA = FITT;
1341           MODEL  MOV_TIME = I;
1342          TITLE *****  YOUNG GROUP ****;
1343

NOTE: THE PROCEDURE GLM USED 0.93 SECONDS AND 154K AND PRINTED PAGE 7.

1343           DATA FITT;  SET G_I;
1344          IF I<5.5 OR G=1  THEN DELETE ;
1345

NOTE: DATA SET WORK.FITT HAS 12 OBSERVATIONS AND 3 VARIABLES. 260 OBS/TRK.
NOTE: THE DATA STATEMENT USED 0.38 SECONDS AND 104K.

1345          PROC GLM  DATA = FITT;
1346           MODEL  MOV_TIME = I;
1347          TITLE *****  OLD GROUP ****;
1348

NOTE: THE PROCEDURE GLM USED 0.81 SECONDS AND 154K AND PRINTED PAGE 8.

1348          PROC SORT  DATA=INDIF ;   BY  I  ;
1349

NOTE: SORT IS NOT SUPPORTED BY THE AUTHOR OR BY SAS.
NOTE: DATA SET WORK.INDIF HAS 38400 OBSERVATIONS AND 15 VARIABLES. 58 OBS/TRK.
NOTE: THE PROCEDURE SORT USED 44.99 SECONDS AND 110K.

1349          PROC  MEANS  DATA = INDIF ;
```

***** YOUNG GROUP **** 0:09 WEDNESDAY, MAY 24, 1978 7

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: MOV_TIME

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	58559.51683998	56559.51683998	19.91	0.0012	0.665631	7.8299
ERROR	10	29416.47001066	2941.64700107		STD DEV		MOV_TIME MEAN
CORRECTED TOTAL	11	87975.98685064			54.23695236		692.69118056

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
I	1	56559.51683998	19.91	0.0012	1	56559.51683998	19.91	0.0012

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	399.21043391	5.90	0.0002	67.61503235
I	33.44319374	4.46	0.0012	7.49536337

***** OLD GROUP **** 0:09 WEDNESDAY, MAY 24, 1978 8

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: MOV_TIME

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	1	68752.32153337	68752.32153337	22.89	0.0007	0.695986	6.5668
ERROR	10	30031.70036709	3003.17003671		STD DEV		MOV_TIME MEAN
CORRECTED TOTAL	11	98784.02190047			54.80118645		834.51472222

SOURCE	DF	TYPE I SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
I	1	68752.32153337	22.89	0.0007	1	68752.32153337	22.89	0.0007

PARAMETER	ESTIMATE	T FOR H0: PARAMETER=0	PR > |T|	STD ERROR OF ESTIMATE
INTERCEPT	516.51659919	7.56	0.0001	68.31844036
I	36.23703755	4.78	0.0007	7.57334070

```
1                         S T A T I S T I C A L   A N A L Y S I S   S Y S T E M          1:13 WEDNESDAY, APRIL 19, 1978
NOTE: THE JOB RATE HAS BEEN RUN UNDER RELEASE 76.5 OF SAS AT THE UNIVERSITY OF WINDSOR.

1            DATA  P_ERОR ;
2            INPUT  G S C H P_ERROR ;
3            KEEP G S C H P_ERROR ;
4            CARDS ;

NOTE: DATA SET WORK.P_EROR HAS 240 OBSERVATIONS AND 5 VARIABLES.
NOTE: THE DATA STATEMENT USED 1.04 SECONDS AND 99K.

245          PROC SORT  DATA=P_EROR ; BY  G S C H ;
246

NOTE: DATA SET WORK.P_EROR HAS 240 OBSERVATIONS AND 5 VARIABLES.
NOTE: THE PROCEDURE SORT USED 1.41 SECONDS AND 100K.

246          PROC ANOVA  DATA=P_EROR ;
247          CLASSES  G S C H ;
248          MODEL P_ERROR = G S(G) C H G*C G*H C*H S*C(G) S*H(G) G*C*H S*C*H(G);
249          TEST  H=G  E=S(G) ;
250          TEST  H=C  G*C  E=S*C(G) ;
251          TEST  H=H  G*H  E=S*H(G) ;
252          TEST H=C*H  G*C*H  E=S*C*H(G) ;
253          TITLE *************************************************************;
254          TITLE2 **** ANALYSIS OF VARIANCE FOR THE PERCENTAGE OF ERRORS ****;
255         TITLE3 *************************************************************;
256

NOTE: THE PROCEDURE ANOVA USED 4.96 SECONDS AND 148K AND PRINTED PAGES 1 TO 2.

256          PROC SORT  DATA =P_EROR; BY G H ;
257

NOTE: DATA SET WORK.P_EROR HAS 240 OBSERVATIONS AND 5 VARIABLES.
NOTE: THE PROCEDURE SORT USED 1.51 SECONDS AND 102K.
```

```
                    ***************************************************************                 1
                    **** ANALYSIS OF VARIANCE FOR THE PERCENTAGE OF ERRORS ****          1:13 WEDNESDAY, APRIL 19, 1978
                    ***************************************************************

                              ANALYSIS OF VARIANCE PROCEDURE

                                 CLASS LEVEL INFORMATION

                          CLASS       LEVELS      VALUES

                          G              2        1 2

                          S             10        1 2 3 4 5 6 7 8 9 10

                          C              4        1 2 3 4

                          H              3        2 3 4

                          NUMBER OF OBSERVATIONS IN DATA SET = 240
```

```
************************************************************************
**** ANALYSIS OF VARIANCE FOR THE PERCENTAGE OF ERRORS ****          1:13 WEDNESDAY, APRIL 19, 1978    2
************************************************************************

                          ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: P_ERROR

SOURCE              DF     SUM OF SQUARES      MEAN SQUARE      F VALUE       PR > F      R-SQUARE          C.V.

MODEL              239         0.00684490       0.00002864     99999.99       0.0000      1.000000        0.0000

ERROR                0         0.00000000       0.00000000                   STD DEV                P_ERROR MEAN

CORRECTED TOTAL    239         0.00684490                                 0.00000000                  0.00297917

SOURCE              DF          ANOVA SS       F VALUE      PR > F

G                    1        0.00000010             .           .
S(G)                18        0.00035938             .           .
C                    3        0.00002865             .           .
H                    2        0.00134333             .           .
G*C                  3        0.00006965             .           .
G*H                  2        0.00000333             .           .
C*H                  6        0.00005167             .           .
S*C(G)              54        0.00115479             .           .
S*H(G)              36        0.00099500             .           .
G*C*H                6        0.00009667             .           .
S*C*H(G)           108        0.00274333             .           .

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S(G) AS AN ERROR TERM

SOURCE              DF          ANOVA SS       F VALUE      PR > F

G                    1        0.00000010          0.01      0.9432

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*C(G) AS AN ERROR TERM

SOURCE              DF          ANOVA SS       F VALUE      PR > F

C                    3        0.00002865          0.45      0.7243
G*C                  3        0.00006865          1.07      0.3703

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*H(G) AS AN ERROR TERM

SOURCE              DF          ANOVA SS       F VALUE      PR > F

H                    2        0.00134333         24.30      0.0001
G*H                  2        0.00000333          0.06      0.9416

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*C*H(G) AS AN ERROR TERM

SOURCE              DF          ANOVA SS       F VALUE      PR > F

C*H                  6        0.00005167          0.34      0.9143
G*C*H                6        0.00009667          0.63      0.7025
```

```
1                                  S T A T I S T I C A L   A N A L Y S I S   S Y S T E M          12:01 THURSDAY, APRIL 20, 1978
NOTE: THE JOB RATE HAS BEEN RUN UNDER RELEASE 76.5 OF SAS AT THE UNIVERSITY OF WINDSOR.

1           DATA  HRATE;
2           INPUT  G S C H R ;
3           KEEP  G S C H R ;
4           CARDS ;

NOTE: DATA SET WORK.HRATE HAS 120 OBSERVATIONS AND 5 VARIABLES.
NOTE: THE DATA STATEMENT USED 0.63 SECONDS AND 98K.

125         PROC SORT  DATA=HRATE ;
126         BY G S C H ;
127

NOTE: DATA SET WORK.HRATE HAS 120 OBSERVATIONS AND 5 VARIABLES.
NOTE: THE PROCEDURE SORT USED 1.14 SECONDS AND 100K.

127         PROC ANOVA  DATA=HRATE ;
128         CLASSES G S C H ;
129         MODEL  R= G S(G) C H C*H G*C G*H S*C(G) S*H(G) G*C*H S*C*H(G) ;
130         TEST H=G  E=S(G)  ;
131         TEST  H=H G*H  E=S*H(G) ;
132         TEST  H=C G*C  E=S*C(G) ;
133         TEST  H=C*H G*C*H  E=S*C*H(G) ;
134         TITLE1 ANALYSIS OF VARIANCE FOR THE INCREASE IN HEART RATE   ;
135        TITLE2 ******************************************************   ;
136        TITLE3       * DEPENDENT VAR.: R :% INCREASE IN HEART RATE *   ;
137        TITLE4       * INDEPEN. VAR. : S : SUBJECTS                *   ;
138         TITLE5      *                 G : AGE                     *   ;
139         TITLE6      *                 C : CLEARANCE               *   ;
140         TITLE7      *                 H : INFORMATION LOAD        *   ;
141         TITLE8      ********************************************** ;

NOTE: THE PROCEDURE ANOVA USED 2.84 SECONDS AND 144K AND PRINTED PAGES 1 TO 2.

142       PROC SORT  DATA=HRATE;
143         BY  G  S ;
144

NOTE: DATA SET WORK.HRATE HAS 120 OBSERVATIONS AND 5 VARIABLES.
NOTE: THE PROCEDURE SORT USED 1.13 SECONDS AND 102K.

144         PROC MEANS  DATA=HRATE ;
145         BY  G  S ;
146         VAR  R ;
147         OUTPUT  OUT=SUBJ  MEAN=RATES ;
148         TITLE  ***  MEAN OF THE  % HEART RATE INCREAS FOR THE TWO GROUPS ***;
149

NOTE: DATA SET WORK.SUBJ HAS 20 OBSERVATIONS AND 3 VARIABLES.
NOTE: THE PROCEDURE MEANS USED 0.91 SECONDS AND 110K AND PRINTED PAGES 3 TO 4.

149         PROC SORT  DATA=HRATE ;  BY  G  H ;
150

NOTE: DATA SET WORK.HRATE HAS 120 OBSERVATIONS AND 5 VARIABLES.
NOTE: THE PROCEDURE SORT USED 1.19 SECONDS AND 102K.

150         PROC  MEANS  DATA=HRATE ;
151         VAR  R ;  BY  G H ;
152         OUTPUT  OUT = FIGR  MEAN=H_RATE ;
153         TITLE ***********************************************************;
154        TITLE2 *** EFFECT OF INFORMATION LOAD ON % INCREASE IN HEART RATE ***;
155        TITLE3 ***********************************************************;
156

NOTE: DATA SET WORK.FIGR HAS 6 OBSERVATIONS AND 3 VARIABLES.
NOTE: THE PROCEDURE MEANS USED 0.68 SECONDS AND 114K AND PRINTED PAGE 5.

156         PROC  SCATTER  DATA=FIGR ;
157         PLOT  H_RATE*H=G ;
158

NOTE: THE PROCEDURE SCATTER USED 0.66 SECONDS AND 110K AND PRINTED PAGE 6.
```

```
2                  S T A T I S T I C A L   A N A L Y S I S   S Y S T E M          12:01 THURSDAY, APRIL 20, 1978
158        PROC  SORT  DATA=HRATE ;  BY  G C ;
159

NOTE: DATA SET WORK.HRATE HAS 120 OBSERVATIONS AND 5 VARIABLES.
NOTE: THE PROCEDURE SORT USED 1.31 SECONDS AND 106K.

159        PROC  MEANS  DATA=HRATE ;
160        VAR  R ;
161        BY  G  C  ;
162        OUTPUT  OUT=FIGR  MEAN= H_RATE ;
163        TITLE ***************************************************************;
164        TITLE2 **** EFFECT OF CLEARANCE ON % INCREASE IN HEART RATE  ****  ;
165        TITLE3 ***************************************************************;
166

NOTE: DATA SET WORK.FIGR HAS 4 OBSERVATIONS AND 3 VARIABLES.
NOTE: THE PROCEDURE MEANS USED 0.63 SECONDS AND 114K AND PRINTED PAGE 7.

166        PROC SCATTER  DATA=FIGR ;
167        PLOT  H_RATE*C=G ;

NOTE: THE PROCEDURE SCATTER USED 0.59 SECONDS AND 110K AND PRINTED PAGE 8.

NOTE: BARR, GOODNIGHT, SALL AND HELWIG
      SAS INSTITUTE INC.
      P.O. BOX 10066
      RALEIGH, N.C. 27605
```

```
          ANALYSIS OF VARIANCE FOR THE INCREASE IN HEART RATE      12:01 THURSDAY, APRIL 20, 1978    1
*************************************************************
      * DEPENDENT VAR.: R :% INCREASE IN HEART RATE *
      * INDEPEN. VAR. : S : SUBJECTS                *
      *                 G : AGE                     *
      *                 C : CLEARANCE               *
      *                 H : INFORMATION LOAD        *
      ***********************************************

              ANALYSIS OF VARIANCE PROCEDURE

                 CLASS LEVEL INFORMATION

          CLASS      LEVELS     VALUES

          G             2       1 2

          S            10       1 2 3 4 5 6 7 8 9 10

          C             2       1 4

          H             3       2 3 4

          NUMBER OF OBSERVATIONS IN DATA SET = 120
```

ANALYSIS OF VARIANCE FOR THE INCREASE IN HEART RATE   12:01 THURSDAY, APRIL 20, 1978   2

```
**************************************************************
* DEPENDENT VAR. : R : % INCREASE IN HEART RATE *
* INDEPEN. VAR.  : S : SUBJECTS                 *
*                  G : AGE                      *
*                  C : CLEARANCE                *
*                  H : INFORMATION LOAD         *
*************************************************
```

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: R

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	119	0.11621187	0.00097657	99999.99	0.0000	1.000000	0.0000
ERROR	0	0.00000000	0.00000000		STD DEV		R MEAN
CORRECTED TOTAL	119	0.11621187			0.00000000		0.03433333

SOURCE	DF	ANOVA SS	F VALUE	PR > F
G	1	0.00436813	.	.
S(G)	18	0.05947407	.	.
C	1	0.00520083	.	.
H	2	0.00147372	.	.
C*H	2	0.00010582	.	.
G*C	1	0.00008003	.	.
G*H	2	0.00055872	.	.
S*C(G)	18	0.01367013	.	.
S*H(G)	36	0.01830823	.	.
G*C*H	2	0.00035222	.	.
S*C*H(G)	36	0.01261497	.	.

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
G	1	0.00436813	1.32	0.2653

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*H(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
H	2	0.00147872	1.45	0.2471
G*H	2	0.00055872	0.55	0.5821

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*C(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
C	1	0.00520083	6.85	0.0175
G*C	1	0.00008003	0.11	0.7492

TESTS OF HYPOTHESES USING THE ANOVA MS FOR S*C*H(G) AS AN ERROR TERM

SOURCE	DF	ANOVA SS	F VALUE	PR > F
C*H	2	0.00010582	0.15	0.8634
G*C*H	2	0.00035222	0.50	0.6092

APPENDIX E

- Tests on Homogeneity of Interactions with Subjects Using Bartlett's Test

E.1 Decision Time Model

Interaction	SS	MS	df	log MS	1/df
HxS(G)	1321610.8	36711	36	4.565	.0278
CxS(G)	1582234.0	29300	54	4.467	.0185
DxS(G)	100828	1867	54	3.271	.0185
HxCxS(G)	1726261	15984	108	4.203	.0093
HxDxS(G)	165200	1529	108	3.184	.0093
CxDxS(G)	175938	1086	162	3.036	.0062
HxCxDxS(G)	277034	855	324	2.932	.0031
	$\sum SS = 5349105$		$\sum df = 846$		$\sum 1/df = .0926$

$$MS_{pooled} = (\sum SS)/\sum df = 6322.8$$

$$A = \sum[(df)_i \log MS_i] = 2821.8$$

$$B = (\sum df) \log MS_{pooled} = 846 \times 3.8 = 3215.6$$

$$C = 1 + \frac{1}{3(K-1)} [\sum(1/df) - (1/\sum df)]$$

$$= 1 + \frac{1}{18} [.0926 - .00118] = 1.005$$

$$\chi^2 = \frac{2.303(B-A)}{C} = 902.4$$

K = number of $MS_i = 7$ $\qquad \chi^2_{.95,(K-1)} = 14.1$

E.2 Movement Time Model

Interaction	SS	MS	d.f	log MS	1/df
HxS(G)	336227.5	9339.6	36	3.970	.0278
CxS(G)	1078940.6	19980.3	54	4.300	.0185
DxS(G)	440352.5	8154.7	54	3.911	.0185
HxCxS(G)	994790.0	9211	108	3.964	.0093
HxDxS(G)	254146.8	2353.2	108	3.372	.0093
CxDxS(G)	300948.0	1857.7	162	3.269	.0062
HxCxDxS(G)	445647.2	1537.6	324	3.187	.0031
	$\sum SS = 3851051$		$\sum df = 846$		$\sum 1/df = .0926$

$$MS_{pooled} = (\sum SS)/\sum df = 4552$$

$$A = \sum[(df)_i \log MS_i] = 2940.8$$

$$B = (\sum df)\log MS_{pooled} = 3094.8$$

$$C = 1 + \frac{1}{3(K-1)}[\sum(1/df) - (1/\sum df)]$$

$$= 1 + \frac{1}{18}[.0914] = 1.005$$

$$\chi^2 = \frac{2.303(B-A)}{C} = 352$$

$$K = 7 \quad \chi^2_{.95,7} = 14.1$$

E.3 Performance Errors Model

Interaction	SS	MS	d.f	log MS	1/df
HxS(G)	0.0664	0.00180	36	-2.745	0.0278
CxS(G)	0.0573	0.00110	54	-2.959	0.0185
HxCxS(G)	0.1749	0.00162	108	-2.79	.00926
	$\sum SS = 0.2986$		$\sum df = 198$		$\sum 1/df = .0556$

$$MS_{pooled} = (\sum SS)/\sum df = 0.0015$$

$$A = \sum[(df)_i \log MSi] = -559.9$$

$$B = \sum df \log MS_{pooled} = -559.1$$

$$C = 1 + \frac{1}{3(K-1)} [\sum(1/df) - 1/\sum df]$$

$$= 1 + \frac{1}{6} [0.0556 - 0.00505]$$

$$= 1.008$$

$$\chi^2 = \frac{2.303(B-A)}{C} = 1.8$$

K = number of $MS_i = 3$ $\quad \chi^2_{.80(K-1)} = 3.22$

E.4 Heart Rate Model

Interaction	SS	MS	df	log MS	1/df
HxS(G)	0.205	0.0057	36	-2.244	0.0278
CxS(G)	0.119	0.0066	18	-2.18	0.0556
CxHxS(G)	0.117	0.0033	36	-2.48	0.0278
$\sum$	0.441		90		0.111

$MS_{pooled} = 0.0049$

$$A = \sum [(df)_i \log MS_i] = -209.3$$

$$B = \sum (df) \log MS_{pooled} = -207.8$$

$$C = 1 + \frac{1}{3(K-1)} [\sum(1/df) - (1/\sum df)]$$

$$= 1.017$$

$$\chi^2 = \frac{2.303(B-A)}{C} = 3.39$$

$K = 3 \qquad \chi^2_{.80(K-1)} = 3.22$

VITA AUCTORIS

1946	Born in Assiut, Egypt, on April 6th.
1960	Completed Secondary Education from Suhag Secondary School, Suhag, Egypt.
1966	Graduated with Bachelor of Science in Mechanical Engineering from Assiut University, Assiut, Egypt.
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